DIVISION OF ENVIRONMENT
QUALITY MANAGEMENT PLAN

PART III:

SURFACE WATER USE DESIGNATION PROGRAM
QUALITY ASSURANCE MANAGEMENT PLAN

Revision 2
12/21/2012

Kansas Department of Health and Environment
Division of Environment
Bureau of Water
Watershed Planning, Monitoring & Assessment Section
1000 SW Jackson St., Suite 420
Curtis State Office Building
Topeka, Kansas 66612

APPROVALS/SIGNATURES

Name: Steve Haslouer
Title: Use Assessment Program Manager

Signature _____ Date 4 February 2013

Name: Mike Butler
Title: Assessment and Information Unit Leader

Signature _____ Date 6 February 2013

Name: Tom Stiles
Title: Watershed Planning, Monitoring and Assessment Section Chief

Signature _____ Date 2/7/13

Name: Mike Tate
Title: Bureau Director, Bureau of Water

Signature _____ Date 2/8/13

Name: Michelle Probasco
Title: Quality Assurance Representative, Bureau of Water

Signature _____ Date 2/4/13

TABLE OF CONTENTS

Section 1

INTRODUCTION

1.1 Purpose of Document

This document presents the quality assurance (QA) management plan for the Kansas surface water use designation program. Quality assurance goals, expectations, responsibilities, and program evaluation and reporting requirements are specifically addressed in this plan. Standard operating procedures for the performance of use attainability analyses (UAAs), including the performance of field studies and the compilation of appropriate historical data and other relevant information, are provided in the appendices of the plan.

1.2 Basic Principles

The Kansas surface water quality standards (K.A.R. 28-16-28b through 28-16-28g) establish water quality goals for all streams, lakes and wetlands occurring within the state or forming a portion of the border with an adjoining state. General narrative provisions in the standards extend a basic level of protection to all such waters. Classified waterbodies comprise an important subset of the waters of the state, in that they are assigned specific designated uses under the standards and are subject to numeric water quality criteria and related regulatory provisions. The level of protection afforded by the standards may vary among classified waterbodies depending on their assigned uses and associated water quality criteria (K.A.R. 28-16-28d and -28e).

The designated uses of approximately 2,500 stream segments, lakes and wetlands are delineated in the Kansas Surface Water Register (see K.A.R. 28-16-28d(d)(2)). This register also assigns unique identification numbers and geographical (latitude/longitude) descriptors to individual waterbodies based on U.S. Environmental Protection Agency (EPA) river reach files. Waterbodies are organized in the register by major river basin and hydrological unit code. The locations of all listed waterbodies are depicted in an accompanying series of maps, which are similarly organized by river basin and hydrological unit code. By georeferencing waterbodies and corresponding use designations in this fashion, the register may be expressed as a geographical information system (GIS) coverage and used with other spatial databases in the development of water quality assessment reports, federal and state discharge permits, total maximum daily loads, and related water pollution assessment/control documents and strategies.

Only the state's larger classified waterbodies are typically listed in the surface water register. As permitting issues and other concerns arise for many smaller waterbodies, designated uses must be

identified and documented on a case-by-case basis (K.A.R. 28-16-28d(d)(3)). Moreover, natural phenomena and artificial modifications may alter the physical, chemical and biological character of surface waters and influence their capacity to support the designated uses assigned via the register. Revisions to the standards altering the definition or interpretation of a designated use likewise may create the need for a reassessment. For these reasons the department maintains a program for initially determining, and periodically reexamining, the designated uses of streams, lakes and wetlands.

1.3 Historical Overview

Under the 1965 amendments to the Federal Water Pollution Control Act, states were required to establish water quality criteria protective of the use of surface water for public water supplies, fish and wildlife propagation, recreation, and agricultural, industrial and other legitimate purposes. In 1967, the Kansas Legislature authorized and directed the Kansas State Board of Health to "establish water quality standards for the waters of the state to protect their beneficial uses." The Board of Health complied with this directive by adopting, later that year, the state' s original water quality standards known as River Basin Water Quality Criteria (K.A.R. 28-16-11). Classified surface waters were designated under these standards for public water supply, industrial water supply, recreation (including sports fishing), agricultural purposes, and receipt of treated wastes.

The Federal Clean Water Act (CWA) of 1972 effectively replaced the language of the Federal Water Pollution Control Act and subsequent amendments. Among other important goals, the CWA explicitly sought to (1) restore and maintain the chemical, physical, and biological integrity of the nation's waters, (2) provide for the protection and propagation of fish, shellfish, and wildlife, and (3) provide for recreation in and on the water (Section 101(a)(2)). In developing water quality standards, states were directed by the CWA to consider the use and value of surface water for public water supplies, propagation of fish and wildlife, recreational purposes, and agricultural, industrial, and other beneficial purposes (Section 303(c)(2)(A)). Continued designation of surface waters for the receipt of treated waste was expressly prohibited by the CWA.

In 1973, the Kansas State Board of Health responded to the CWA by adopting a two-tier (A/B) classification system for beneficial use designations. Selected federal reservoirs were given the A classification and designated for body contact recreation, fish and wildlife, public water supply, industrial water supply, and agricultural purposes. Class B waterbodies, which included all major perennial streams and their perennial tributaries, as well as all intermittent tributaries maintaining permanent pools, were designated for secondary contact recreation, fish and wildlife, public water supply, industrial water supply, and agricultural purposes. In 1974, revised water quality standards were adopted by the newly formed Kansas Department of Health and Environment (the successor agency to the Kansas State Board of Health). Although the department retained the earlier A/B

classification system, it assigned the A classification to all publicly owned lakes with facilities for body contact recreation and the B classification to all streams and all privately owned lakes not exempted by K.S.A. 65-171d(d). Formal UAAs were not employed by the department in the identification and assignment of beneficial uses under either the 1973 or 1974 standards.

In 1983, EPA promulgated an amended version of the federal water quality standards regulation (48 FR 51405). This amended regulation defined "existing" uses of surface water as those attained on or after November 28, 1975. It also required that a supporting UAA accompany any decision by a state to forgo the assignment of a CWA Section 101(a) (fishable / swimmable) use, and it provided for the removal of a designated use, other than an existing use, if natural, hydrological or structural features of a waterbody prevented attainment of the use or if compliance with the use designation would impose a widespread social and economic hardship. This revised regulation subsequently played a major role in determining the level of protection afforded the waters of the state (discussed below).

In 1986, the department again amended the Kansas surface water quality standards. The A/B use classification system was removed from the standards but all prior use designations were carried over from the previous standards. Classified streams under the 1986 standards included all running waters with mean summer base flows exceeding 0.1 cubic foot per second, all intermittent streams in which pooling of water provided for the support of aquatic wildlife, and all associated springs, alluvial aquifers, and riparian wetlands. Classified lakes included all publicly owned lakes and all privately owned lakes providing facilities for public recreation. Classified wetlands were limited to the state's larger, publicly owned wildlife refuges. All classified streams and lakes were designated for irrigation, livestock watering, one of three aquatic life support uses (special, expected or restricted), domestic water supply, industrial water supply, groundwater recharge, consumptive recreation, noncontact (secondary contact) recreation, and (primary or body) contact recreation where this latter use was known to occur. All classified wetlands were designated for noncontact recreation, consumptive recreation, and aquatic life support.

EPA approved the amended standards on the condition that the department agree to perform UAAs for those surface waters lacking the contact recreational designation. In June 1986, Kansas State University (KSU) was awarded a departmental contract to provide "a means of documenting for EPA purposes, the use attainability of contact recreation in Kansas surface waters." Procedures for contact recreational UAAs were finalized by KSU and detailed in a written report the following year (Cable and Udd 1987). During the ensuing 18-month period, a total of 215 recreational UAAs were conducted by the department pursuant to the KSU protocols.

The department again promulgated revised water quality standards in 1994, adopting, by reference, the newly developed Kansas Surface Water Register. This register established beneficial use designations for essentially all publicly owned lakes, publicly owned wetlands, and most named

streams appearing on U.S. Geological Survey 7.5-minute topographical maps. All classified surface waters were designated for noncontact recreation and one of three categories of aquatic life support (special, expected or restricted). Contact recreation was assigned to many newly listed waterbodies based on documented occurrences of swimming or on the results of formal UAAs. Food procurement was assigned to all waterbodies previously designated for consumptive recreation, in addition to all newly listed waterbodies characterized as significant angling resources by the Kansas Department of Wildlife and Parks (Moss and Brunson 1981). Newly listed waters were designated for domestic water supply, industrial water supply, irrigation and/or livestock watering where these uses were known to occur. Groundwater recharge was assigned to newly listed waterbodies based on the documented presence of sand, gravel, fractured bedrock or other permeable substrata.

The department revised the standards again in 1999 but continued to assign primary contact recreation, food procurement, water supply, and groundwater recharge uses to surface waters on a selective basis (i.e., only where supported by a UAA). EPA objected to this approach, arguing that, at a minimum, all CWA Section 101(a) uses should automatically be assigned to any stream, lake or wetland lacking a formal UAA. During this same period, four public forums were conducted jointly by KDHE and the Docking Institute of Public Affairs, Fort Hays State University, to solicit input on proposed procedures for conducting UAAs. In March of 2001, KDHE and EPA negotiated a Memorandum of Understanding (MOU) and a schedule to conduct UAAs on those streams and lakes that were previously assigned a default secondary contact recreation use. In the spring of 2001, KDHE began to conduct recreational UAAs on surface water segments designated for secondary contact recreation for which assessments had not previously been completed (1,456 surface water segments). KDHE also conducted recreational and food procurement UAAs on classified lakes where a UAA had not been previously conducted.

On April 13, 2001, Governor Graves signed into law Substitute for Senate Bill 204, K.S.A. 2001 Supp. 82a-2001, with an effective date of September 1, 2001. Essentially, this law changed the definition for classification and use designation of streams only. Also, the law requires a recreational UAA survey to be conducted on all stream segments of the state where a recreational UAA has not been completed prior to October 31, 2005. In addition, the department is to complete a designated UAA for all other uses by December 31, 2007 (required by Statute K.S.A. 82a-2004). The department again revised the Kansas Surface Water Quality Standards in 2002. During the 2003 Session of the Kansas Legislature, Substitute for Senate Substitute for HB2219 (Bill) was passed. The Bill, which modified portions of the standards, became effective May 1, 2003. This action amended K.S.A. 2002 Supp. 82a-2001 modifying the definition of classified stream segments and creating new sub-classes of both primary and secondary contact recreational use. The department again revised the standards in 2003, adopting, by reference, the newly developed Kansas Surface Water Register.

In July 2012, a reorganization of the Division of Environment moved the Surface Water Use Designation Program to the newly formed Watershed Planning, Monitoring and Assessment Section (WPMAS) within the Bureau of Water (BOW) as part of the Assessment and Information Unit.

1.4 Program Objectives

The surface water use designation program endeavors to provide scientifically defensible information on the existing and attainable uses of classified streams, lakes and wetlands. This information is intended for use in:

(1) complying with federal and state requirements for designating the beneficial uses of surface water (40 CFR 131.10; K.A.R. 28-16-28d);

(2) responding to changes in the capacity of surface waters to support the designated uses recognized under the Kansas standards;

(3) identifying and applying appropriate water quality criteria and related regulatory provisions in the development of National Pollutant Discharge Elimination System (NPDES) permit limits, wasteload allocations, load allocations, and total maximum daily loads; and

(4) responding to possible future changes in the wording of the Kansas standards with respect to the beneficial uses of surface water.

Section 2

QUALITY ASSURANCE GOALS

The goal of this management plan is to ensure that all monitoring data obtained through the use designation program are of known and acceptable quality. Known quality means that data precision, bias, completeness and representativeness are documented to the fullest practicable extent. Acceptable means that the data fully support the informational needs and regulatory functions of the Division of Environment. The program's success in meeting these goals is judged on the basis of the following performance criteria and expectations:

(1) Where practicable, the reliability of field and laboratory measurements and taxonomic determinations shall be documented in a quantitative fashion. For routine water chemistry parameters, data precision shall be evaluated through the use of replicate samples and data bias shall be evaluated through the use of sample blanks and spiked samples. The average coefficient of variation among replicate samples shall, for all parameters, be less than 20 percent. Spike recoveries shall average between 80 and 120 percent of actual spike concentrations. Background contaminant levels (determined through the analysis of procedural or "field" blanks) shall constitute, on average, less than 10 percent of the reported sample concentrations.

For routine biological and habitat metrics, the precision of the data shall be evaluated through periodic replicate sampling or scoring activities conducted simultaneously by two or more field staff. Values for biological metrics are expected to vary, on average, less than 20 percent among program personnel. Bias, as the term is applied in a taxonomic context, refers to error resulting from the incorrect identification of biological specimens. Taxonomic bias is evaluated and minimized through the use of reference specimens and through internal and external audits of taxonomic performance. As a general goal, fewer than one percent of the specimens collected in the course of sampling activities shall be misidentified by program personnel.

(2) Loss of physicochemical and microbiological data due to sample collection, transport or analytical problems, or to the subsequent mishandling of data, shall be limited to less than five percent of the data originally scheduled for generation. Loss of biological data due to specimen collection, transport or storage problems, or to the subsequent mishandling of data, shall be limited to less than two percent of the data originally scheduled for generation. Where problems occur and a substantial quantity of data is lost, an effort shall be made to resample and/or re-evaluate surface waters to maximize data completeness.

(3) Changes in the methods used to obtain and analyze physicochemical, biological and habitat data shall be carefully documented through formal revisions to the SOPs appended to, or adopted by reference in, this QA management plan. This requirement is intended to help maintain a reasonably consistent methodology and database over time and to document the effects of any procedural changes on reported contaminant levels, biological metrics, habitat scores, or other assessment parameters.

(4) Data generated through this program shall be compared and contrasted with other available information to examine the representativeness of program findings relative to any other reported results. Staff shall attempt to ascertain the probable causes of any discrepancies between the various existing databases and describe, in end-of-year program reports, the magnitude and practical significance of such discrepancies.

Section 3

QUALITY ASSURANCE ORGANIZATION

3.1 Administrative Organization

The general administrative structure of the surface water use designation program is depicted in Figure 3.1-1, below.

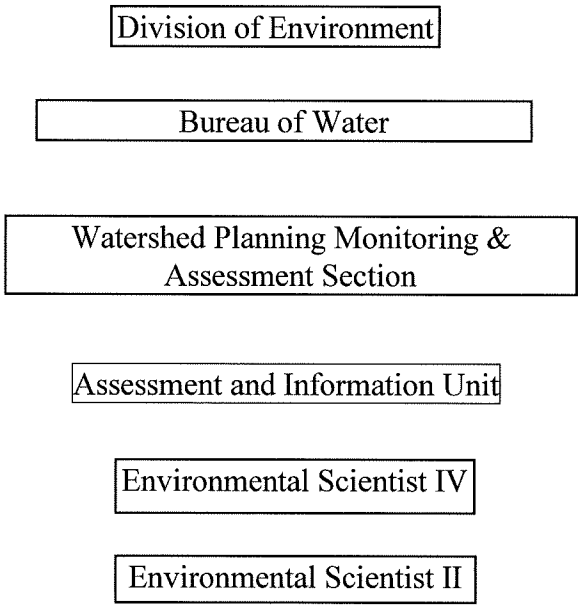


Figure 3.1-1. Administrative hierarchy of surface water use designation program

3.2 Staff Responsibilities

Program employees include one environmental scientist IV and one environmental scientist II.. The environmental scientist IV serves as program manager and is accountable for most program planning, data interpretation, and report writing functions. This employee also participates in field work, monitors program QC, notifies the unit leader of any equipment needs or staff training needs, and participates in the annual review and revision of the program QA management plan (see section 5). The environmental scientist II routinely schedules and participates in field activities, serves as UAA crew leader, serves as the program's principle liaison with the Kansas Health and Environmental Laboratory (KHEL), prepares computer generated reports and other related documents at the request of the section chief, and maintains the UAA computer database. To help with the additional field and office duties, the program manager may arrange for contractual services and/or interns to meet the expectations of the program.

In the event of unscheduled staff absences, or when additional people are needed to conduct UAAs and related work in a timely, safe, and efficient manner, the section chief may temporarily assign personnel from other monitoring programs to the use designation program. Conversely, staff normally assigned to the use designation program may be called upon to assist with other departmental monitoring programs. In the performance of UAAs and related activities the department may request the assistance of other individuals, agencies or organizations, provided these outside parties agree to abide by the requirements of this QA management plan and associated SOPs.

Section 4

QUALITY ASSURANCE PROCEDURES

4.1 Overview of UAA Protocol

Appendix B describes field, office and laboratory procedures employed in the use designation program. In summary, these procedures may involve (1) review of U.S. Geological Survey 7.5-minute topographical maps and available aerial photographs of the study area, (2) procurement of available information on the properties and uses of the stream, lake or wetland in question, (3) procurement of landowner permission to access the targeted waterbody if private property is involved, (4) performance of interviews with local residents, property owners and other knowledgeable parties, (5) visual inspection of the targeted waterbody or waterbody segment, (6) selection of one or more representative sites for gathering water quality data and assessing the biological community and available biological habitat for determining aquatic life support use, (7) documenting the features of the selected site(s) via digital photography, global positioning system (GPS) technology, and written notes and field sheets, (8) performance of onsite sampling and assessment activities, (9) conveyance of water chemistry samples to KHEL for processing, and conveyance of field data and biological samples to the BOW Monitoring Lab in Topeka for examination and storage, (10) preparation of a written report on the results of the UAA, and (11) archiving UAA data and supporting materials pending the next scheduled review and revision of the water quality standards and surface water register.

4.2 Waterbody Selection and Prioritization

Occasionally, the existing and attainable uses of a given waterbody are unknown but must be ascertained as soon as possible to facilitate a formal administrative decision or regulatory action. Waterbodies falling into this category are generally given the highest priority in the scheduling and performance of UAAs. Waterbodies with questionable use assignments, or assignments which have been challenged by members of the regulated community, interest groups, or the general public, also receive a high priority in the scheduling and performance of UAAs. The department is on an accelerated schedule to complete UAAs on classified streams of the state due in part to the state statute K.S.A. 82a- 2004

4.3 Procurement of Available Information

Available data and documentation may allow for the accurate characterization of the existing and/or attainable designated uses of a waterbody, in some cases eliminating the need for a detailed field

study. Published reports and databases maintained by the Kansas Biological Survey (KBS), the University of Kansas Museum of Natural History, the Kansas Department of Wildlife, Parks and Tourism, the Kansas Geological Survey, the U.S. Geological Survey, the Kansas Division of Water Resources, and other agencies often provide detailed information on the biological, geological and/or hydrological properties of individual waterbodies. These reports and databases may provide information useful in determining a waterbody=s classification status and capacity to support the uses recognized under the standards. The compilation and review of this available background information is usually one of the initial steps in the use designation process (Appendix B).

4.4 Selection of Sampling/Assessment Sites

4.4.1 Water Chemistry, Biological Habitat, and Aquatic Life Support Evaluations

Except as indicated in the next paragraph, most physicochemical and biological sampling activities and habitat assessments are performed at locations deemed representative of the waterbody (or waterbody segment) in question. Such locations generally are unimpacted by localized disturbances or unusual site-specific factors. Field activities begin with visual inspection of the targeted waterbody at several randomly selected locations. Those locations deemed most representative of the waterbody are selected for further study. Stream assessments generally entail the selection of at least three representative locations, whereas lake and wetland assessments typically involve only a single representative site.

If a site is believed to afford unusual or outstanding biological habitat, it is included as an additional study location even if unrepresentative of the waterbody as a whole. This increases the likelihood that rare species or unusual biological assemblages will be discovered and assigned an appropriate level of protection under the water quality standards (see K.A.R. 28-16-28c(a)(1)(B)(4) and -28d(b)(2)(A) or K.S.A. 82a-2001(c)(2)(A).

4.4.2 Recreational, Water Supply, and Groundwater Recharge Evaluations

In the performance of recreational UAAs, public access points (camp grounds, boat ramps, low water bridges, etc.) may yield direct visual evidence of primary contact recreation. Similarly, conversations with area residents, and careful inspection of available maps and aerial photographs, may lead to the discovery of existing swimming holes or deeper pools readily accommodating bodily immersion but virtually unidentifiable in a random survey. An effort is made by staff to identify and survey all such sites before concluding that primary contact recreation is not an existing or attainable use of a targeted waterbody (Appendix B).

UAAs addressing the issue of water supply are likewise conducted at locations with the greatest potential for this use. Under Kansas water allocation law (K.S.A. 82a-706), the limited withdrawal

of surface water by any person or family unit or household for household purposes, or for the watering of livestock, poultry, farm and domestic animals used in operating a farm, and for the irrigation of lands not exceeding a total of two acres in area for the growing of gardens, orchards and lawns may legally occur even in the absence of a formal appropriation from the Division of Water Resources. Conversations with local residents may confirm that water supply is indeed an existing designated use as defined by the surface water quality standards (K.A.R. 28-16-28b(z). Similarly, published studies and discussions with local residents may assist in the identification of surface water reaches meriting the groundwater recharge designation (Appendix B).

4.5 Sample Collection and Preliminary Measurements

4.5.1 Streams (as defined by K.A.R. 28-16-28b(fff)(1))

4.5.1.1 Protocols for collection of biological specimens and performance of habitat assessments

Stream macroinvertebrate sampling protocols involve a time-based "equal effort" method which is similar in some respects to EPA's Rapid Bioassessment Protocol III (Appendix B; cf., Plafkin *et al.* 1989). During each sampling event, macroinvertebrate specimens are collected by two trained workers for thirty minutes or a combined duration of one "person-hour." An effort is made to sample all available habitat types (riffles, pools, runs, woody debris, undercut banks, etc.) within the allotted time period. Specific methods of collection include, but are not necessarily limited to (1) kicking riffles and leaf packets and allowing the current to carry dislodged organisms into D-frame nets; (2) sweeping D-frame nets through submersed or floating aquatic vegetation, submersed terrestrial vegetation and tree roots, accumulations of woody debris, and growths of filamentous algae; (3) sieving fine sediments (silt/fine sand) through D-frame nets; and (4) using forceps to pick organisms directly from logs, large rocks, or other objects not easily dislodged by kicking.

Field staff endeavor to collect a combined total of at least 200 organisms. Specimens of a given taxon are collected in numbers roughly proportional to their relative abundance in the stream community and placed in 120-ml glass jars containing 70 to 80 percent ethyl alcohol. The site location and date of collection are written with indelible marker on label tape affixed to the outside of the jars. Upon completion of sampling, the station location, time and date of sample collection, names of field workers, and weather and flow conditions at the time of sampling are recorded on a sample collection form. Prior to leaving the monitoring station, stream temperature is measured (GQMP-004.II.B), a Winkler DO sample is collected and preserved (APHA 1989), and a habitat assessment form is completed (Appendix B).

A separate survey for unionid mussels is performed if evidence of mussels is encountered during the above sampling activities or during the preliminary stream survey (see section 4.4.1). This

qualitative effort entails visual inspection of exposed sand and gravel bars, shallow shoreline reaches, and riffle areas. At least one person-hour is devoted to this activity. Live mussel specimens encountered during the survey are identified in the field by staff skilled in mussel identification. Live specimens of questionable taxonomy, and any live T/E and SINC specimens, are generally photographed and released onsite rather than retained for voucher purposes. Recently deceased specimens and weathered / relict mussel shells are collected and transported to the BOW Monitoring Lab in Topeka in labeled plastic bags.

Fish sampling procedures typically involve the use of a 6' X 4' seine (1/4" mesh) or, in larger streams, a 15' X 6' seine (3/8" mesh). Available habitats are sampled repeatedly until no new fish species is collected in three successive seine hauls. Because deeper pools or reaches strewn with woody debris, large rocks or trash may preclude the use of seines, the program manager may elect to utilize electro-shocking equipment, gill nets or other sampling apparatus (Appendix B). Most captured specimens are identified to species or subspecies and enumerated in the field; however, any unusual, rare, or very small fish are preserved in a 10-percent formalin solution and stored in labeled containers for subsequent laboratory verification. Worksheets are completed onsite to document the fish habitat characteristics of the sampled stream reach (Appendix B).

Voucher fish and invertebrate specimens (including unionid mussel specimens) are maintained indefinitely by BOW or, in the case of very rare specimens, transferred to KBS, the Kansas University Museum of Natural History, or other established repositories. Reference collections are maintained at the BOW Monitoring Lab to assist in the training and testing of field staff.

4.5.1.2 Protocols for collection, preliminary analysis, preservation and transport of water chemistry samples

Water chemistry samples generally are collected from shallow stream reaches by wading to the center of the stream and manually dipping a stainless steel sampling pail below the surface of the water. For larger, deeper streams, samples are collected from boats or bridges with the aid of a rope and a specially fabricated stainless steel sampling bucket or, in the case of pesticide or radiological samples, a stainless steel pail; again, samples are normally collected from the center of the stream channel (or from the deepest appearing portion of the channel in braided streams) to minimize sediment resuspension and maximize the representativeness of the sample. All samples are transferred to a specially equipped field vehicle where preliminary measurements are performed and the samples are fractionated and preserved prior to delivery to KHEL.

4.5.1.3 Sample Containers

Several types of samples are actually gathered by program staff, and each is transported and stored in

its own specific kind of container (Appendix B). After sample collection, the weighted stainless steel sample bucket is gently swirled between each of the poured fractions. The fraction reserved for mineral determinations is ultimately transferred to a one-quart plastic cubitainer; the aliquot reserved for heavy metal analysis is transferred to an acid-washed 175-ml Nalgene bottle; the aliquot reserved for the nutrient analysis is transferred to a 175-ml Nalgene bottle; the aliquot reserved for the bacterial analysis is transferred to an autoclaved 250-ml polyethylene bottle. The remaining portion of the sample provides water for pH and temperature measurements. Pesticide samples are transferred from a stainless steel pail to a one-gallon dark glass bottle with a Teflon-lined plastic cap. Radiological samples are transferred to a one-gallon polyethylene jug, except for the tritium sample fraction which is transferred to a 100-ml glass bottle.

4.5.1.4 Sample Preservation

Methods employed in the preservation of stream water samples are described in detail in Appendix B. In summary, mineral, nutrient, heavy metal, pesticide and bacteriological samples are stored in the dark, on ice, pending transfer to KHEL. Heavy metal sample bottles and radiological sample jugs supplied by KHEL are pre-acidified with nitric acid, whereas nutrient sample bottles require the addition of 1 ml of 1:30 (v/v) sulfuric acid upon transfer to the field vehicle. Dissolved oxygen samples are analyzed via the Winkler titration technique and are preserved in the field vehicle using appropriate additions of manganous sulfate, alkaline potassium iodide azide, and concentrated sulfuric acid (APHA 1992); once the sulfuric acid is added, the DO samples are stored in the dark pending transfer to KHEL (Appendix B).

4.5.1.5 Preliminary Measurements

Temperature is measured to the nearest ^{o}C using a Fisher model #15-0778 stainless-steel dial scale thermometer, which is placed directly in a 50-ml beaker following transfer of the sample to the field vehicle. pH measurements are performed on the same 50-ml sample aliquot using a Cole Parmer model #5996-70 portable pH meter or comparable instrument. All measurements are recorded on the field recording sheet along with other pertinent information (see Appendix B).

4.5.2 Lakes and Wetlands (as defined by K.A.R. 28-16-28b(fff)(2 & 3)

4.5.2.1 Protocols for collection of biological specimens and performance of habitat assessments

Bacteriological and phytoplankton samples are collected from the shoreline of smaller lakes and

wetlands using an extendable pole with a small, polyvinyl chloride sampling "bucket" at one end. All such samples are collected from a few centimeters beneath the water surface to avoid materials floating at the air/water interface. On occasion, a fish cleaning station may be equipped with a small

hand pump that draws water from just beneath the surface of a lake. Samples may be collected directly from such pumps, provided the pumps and associated tubing are first flushed with at least five volumes of lake water. In larger lakes and wetlands, microbiological samples may be obtained during physicochemical sampling activities by reserving an aliquot from each Kemmerer surface pull (Appendix B). All bacteriological samples are stored in autoclaved 250-ml polyethylene bottles; all phytoplankton samples are stored in 100-ml brown polyethylene bottles. Samples collected for algal taxonomy are preserved with 1.5 ml of Lugol's solution for each 100 ml of sample (APHA, 1992). Zooplankton samples are washed into collection jars using 70 percent ethanol (APHA, 1992). All microbiological samples are stored in the dark during transfer to KHEL or the BOW Monitoring Lab, Topeka office. Macrophyte specimens that cannot be identified onsite are stored in labeled plastic bags, on ice, in the dark, and transported to the BOW Monitoring Lab in Topeka for identification.

Macrophyte sampling techniques entail a point-quadrat approach. At each lake, sampling activities are conducted at 10-20 locations depending on the surface area of the waterbody. Sampling points are arranged in a regular grid pattern and are first identified on a map of the lake copied from one or more USGS 1:24,000 scale topographic maps. The boat is maneuvered to each site indicated on the map, and the approximate position of the site is confirmed by visual cross reference to several topographic features along the shoreline. Staff inspect each site for any evidence of a resident macrophyte community. A grapnel hook attached to a rope is thrown over the boat, drawn over the lake sediments for a distance of 5-6 meters, and manually retrieved. Macrophyte specimens "snared" on the hook are identified immediately, and the species names are recorded on a data sheet (Appendix C, Form 3). Specimens that cannot be identified in the field are brought back to the office in plastic bags; these specimens are stored at 4°C, in the dark, pending identification (Wood, 1967; Fassett, 1972; Winterringer & Lopinot, 1977; and Brooks & Hauser, 1981). Macrophyte abundance is reported as "percent of stations with macrophytes" and is used as a surrogate of areal cover. The same metric is applied to each species as a measure of "relative abundance." The number of documented taxa provides an estimate of species richness.

4.5.2.2 Protocols for collection, preliminary analysis, preservation and transport of water chemistry samples

Water chemistry samples may be collected from the shoreline of most small lakes and wetlands using a stainless steel pail or extensible pole sampler (see SOP LWMP-005). Shallow offshore waters may be accessed by wading provided proper precautions are taken by staff (SOP SBMP-003). Deeper

waters may be accessed by boat, bridge or dock and sampled using a stainless steel pail, Kemmerer bottle or other suitable device (SOP LWMP-001, LWMP-005, SCMP-005). In general, water samples are collected from larger lakes and wetlands with the aid of a 14-foot Jon boat or an 18-foot

pontoon boat. The sampling boat is anchored over the deepest point in the waterbody during sampling activities. In wetlands, this point typically coincides with the center of the largest pool although, due to a lack of boat access, some wetlands are sampled at the main outflow structure. In lakes, the deepest water generally overlies the inundated stream channel within 30-60 meters of the face of the dam. The exact distance varies from lake to lake depending upon the design and slope of the dam, the size and depth of the lake, and other factors.

Several types of samples are gathered by program staff, and each is transported and stored in its own specific kind of container (Appendix B). A complete array of inorganic samples requires the use of one-quart plastic cubitainers ("mineral" parameters and chlorophyll-a), 175-ml Nalgene bottles ("nutrient" parameters), and acid-washed 250-ml Nalgene bottles ("heavy metal" parameters). One-gallon dark glass bottles with Teflon-lined plastic caps are used for the collection of pesticide samples. Samples for the analysis of volatile organic compounds (VOCs) are contained in 40-ml glass vials with Teflon-lined plastic caps.

Samples for the measurement of inorganic constituents (minerals, nutrients, heavy metals) are collected 0.5 meter below the surface of the water and, again, 0.5-1.0 meter above the lake sediments using a Kemmerer sampling apparatus. To minimize the risk of sample contamination, the Kemmerer apparatus is rinsed repeatedly with lake water prior to use. One "pull" from a depth of 0.5 meter fills one set of surface sample containers; a second pull from the same depth is taken to fill the duplicate sample containers. This procedure is repeated for the bottom sample and duplicate bottom sample. (Prior to filling bottom sample containers, the Kemmerer apparatus is "bled" to ensure that no sediment has been collected in the release valve.) In general, bottom samples are not collected from unstratified lakes less than 2.0 meters in maximum depth. If a shallow lake exhibits thermal stratification, field staff collect bottom samples only if it is believed that the activity can be performed without disturbing the sediments and jeopardizing the representativeness of the sample. Bottom samples are not routinely collected from wetlands owing to their shallow nature.

Pesticide samples are collected from lakes and wetlands by manually submerging a one-gallon dark glass bottle and allowing the bottle to fill at a depth of 0.5 meter. Streams entering or exiting lakes/wetlands usually are sampled from bridges. A specially fabricated, stainless steel sampling bucket is manually lowered into the water on a rope. The sample is collected from the deepest appearing portion of the stream channel in order to minimize resuspension of sediments. Samples are normally collected on the upstream side of bridges, unless safety concerns or obstructions dictate otherwise.

Temperature and DO concentrations are measured in lakes at 0.5- or one-meter depth intervals with a Yellow Springs Instrument (YSI) model 51B portable meter, coupled by a cable to a YSI combination thermistor/DO membrane probe (APHA, 1992). A standard 20-cm black and white

Secchi disc is used to measure water column transparency. All Secchi depth measurements are made on the shaded side of the boat, and the mean of the disappearance and reappearance depths is recorded. pH is measured immediately upon return to shore, using aliquots from one "surface" and one "bottom" sample, after standardizing the meter in accordance with the manufacturer's instructions.

Mineral, nutrient, heavy metal, pesticide, chlorophyll-a and bacteriological samples collected during lake/wetland monitoring efforts require storage in the dark, at approximately 4°C, pending transfer to KHEL. Appendix B describes appropriate sample containers, preservation techniques, and storage and holding-time requirements for individual parameters. Heavy metal sample bottles supplied by KHEL are pre-acidified with nitric acid. Nutrient sample bottles are either pre-acidified or, alternatively, require the addition of 1 ml of 1:30 (v/v) sulfuric acid solution following sample collection. In the latter case, the acid is added to nutrient sample bottles immediately upon return to shore. Winkler DO samples are preserved upon return to shore with appropriate additions of $MnSO_4$, alkaline potassium iodide azide, and (after the appropriate settling time) concentrated sulfuric acid (APHA, 1992). Once the sulfuric acid is added, the sample bottles are stored in the dark pending transfer to Topeka for titration (APHA, 1992). Ideally, the Winkler sample is the last sample collected before concluding a lake survey. Chlorophyll-a samples must be filtered and placed in a freezer within 72 hours of collection, an activity normally conducted at the BOW Monitoring Lab in Topeka. Freeze-dried chlorophyll-a samples are analyzed within six weeks of being placed in the freezer (APHA, 1992).

4.6 Sample Handling and Chain-of-Custody

All water chemistry and bacteriological samples must be handled and stored in a fashion which minimizes contamination, leakage and damage during transport. Samples generally are delivered to KHEL the day of collection, prior to the close of business. In the event field staff are unavoidably detained, every effort is made to contact KHEL by telephone to arrange for the late transfer of samples. In general, only those samples collected more than 100 miles from Topeka and analyzed for DO, BOD, fecal coliform bacteria, nitrite and/or ortho-phosphate exceed the maximum holding times established by KHEL. The impact of exceeding such holding times is systematically investigated by the program manager and quantitatively addressed in routine program reports and end-of-year program evaluations.

Standardized sample submission (chain-of-custody) forms are completed for all samples submitted to KHEL (Appendix B). These forms identify sampling location, date and time of sample collection,

personnel involved in the collection of the sample, and analytical parameters of interest;. They also assign to individual samples a unique identification number for future reference. One of the individuals involved in the collection of the sample signs and dates the form and delivers it (with the

sample) to KHEL. Staff of KHEL sign the form and record the date and time of submission on the form to acknowledge receipt of the sample. This basic sign-off procedure also is performed if the sample changes hands prior to arrival at KHEL.

All biological specimens and samples (fish, aquatic macro-invertebrates, aquatic macrophytes, planktonic and non-planktonic algae, etc.) and associated paperwork are transferred to BOW Monitoring Lab in the Curtis State Office Building, Topeka. In the unlikely event a sample is delivered to the BOW Monitoring Lab by someone other than an individual involved in its collection, the name of the courier and the time and date of transfer is recorded on the field collection form. Samples and paperwork are retained in the possession of, or delivered to, the program's environmental scientist II. This employee stores biological samples in a secured location pending taxonomic determinations/enumerations, then files all collection forms and habitat evaluation forms for future reference.

4.7 Laboratory Procedures

Analytical methods employed by KHEL, and associated parameter reporting limits and reporting units, are summarized in tables 4.7-1, 4.7-2, 4.7-3, and 4.7-4.

TABLE 4.7-1

ROUTINE BACTERIOLOGICAL PARAMETERS

PARAMETER	REPORTING LIMIT	REPORTING UNIT	ANALYTICAL METHOD
Escherichia coli	variable	colonies/100 ml	SM 9221B

TABLE 4.7-2

ROUTINE COMPOSITE AND INORGANIC CHEMICAL PARAMETERS

PARAMETER	REPORTING LIMIT	REPORTING UNIT	ANALYTICAL METHOD
Alkalinity	20	mg/L	APHA 2320B
Aluminum	0.05	mg/L	EPA 200.7
Ammonia (N)	0.10	mg/L	EPA 350.1
Antimony	0.05	ug/L	EPA 200.7
Arsenic	1	ug/L	EPA 200.8
Barium	0.02	mg/L	EPA 200.7
Beryllium	0.001	mg/L	EPA 200.7
Biochemical oxygen demand	1	mg/L	APHA 5210B
Boron	0.05	mg/L	EPA 200.7
Bromide	0.20	mg/L	EPA 300.0
Cadmium	1	ug/L	EPA 200.8
Calcium	0.05	mg/L	EPA 200.7
Chloride	0.40	mg/L	EPA 300.0
Chromium	1	ug/L	EPA 200.8
Cobalt	0.01	mg/L	EPA 200.7
Copper	1	ug/L	EPA 200.8
Dissolved oxygen	0.1	mg/L	EPA 360.1
Fluoride	0.15	mg/L	EPA 300.0
Iron	0.01	mg/L	EPA 200.7
Lead	1	ug/L	EPA 200.8
Magnesium	0.05	mg/L	EPA 200.7
Manganese	0.005	mg/L	EPA 200.7
Mercury	0.5	ug/L	EPA 245.1
Molybdenum	0.02	mg/L	EPA 200.7
Nickel	1	ug/L	EPA 200.8
Nitrate (N)	0.1	mg/L	EPA 300.0
Nitrite (N)	0.05	mg/L	EPA 300.0
Ortho-phosphate (P)	0.25	mg/L	EPA 300.0
Potassium	0.05	mg/L	EPA 200.7
Selenium	1	ug/L	EPA 200.8

TABLE 4.7-2 (cont.)

ROUTINE COMPOSITE AND INORGANIC CHEMICAL PARAMETERS

PARAMETER	REPORTING LIMIT	REPORTING UNIT	ANALYTICAL METHOD
pH (field)	0.1	pH unit	APHA 4500-H^+
Strontium	0.1	mg/l	EPA 200.7
Temperature (field)	1	degrees C.	APHA 2550 B
Kjeldahl nitrogen	0.1	mg/l	EPA351.1
Silica	0.1	mg/L	EPA 200.7
Silver	1	ug/L	EPA 200.8
Sodium	0.05	mg/L	EPA 200.7
Specific conductance	35	umhos/cm	APHA 2510B
Sulfate	0.50	mg/L	EPA 300.0
Thallium	0.05	mg/L	EPA 200.7
Total dissolved solids	calculated	mg/L	USGS I-1751-85
Total hardness	calculated	mg/L	APHA 2340B
Total phosphorus (P)	0.02	mg/L	EPA 365.1
Total suspended solids	10	mg/L	EPA 160.2
Turbidity	0.15	NTU	APHA 2130B
Vanadium	0.005	mg/L	EPA 200.7
Zinc	0.005	mg/L	EPA 200.7

TABLE 4.7-3
ROUTINE PESTICIDES AND RELATED COMPOUNDS

PARAMETER	REPORTING UNIT	REPORTING UNIT	ANALYTICAL METHOD
Acetochlor	0.1	ug/L	EPA 608
Alachlor	0.1	ug/L	EPA 608
Aldrin	0.025	ug/L	EPA 608
Atrazine	0.3	ug/L	EPA 608
Butachlor	0.5	ug/L	EPA 608
Carbofuran	0.5	ug/L	EPA608
Chlordane	0.2	ug/L	EPA 608
Cyanazine (Bladex)	0.5	ug/L	EPA 608
DCPA (Dacthal)	0.05	ug/L	EPA 608
p,p=-DDD	0.04	ug/L	EPA 608
p,p=-DDE	0.02	ug/L	EPA 608
p,p=-DDT	0.1	ug/L	EPA 608
Dieldrin	0.05	ug/L	EPA 608
Endosulfan I	0.02	ug/L	EPA 608
Endosulfan II	0.02	ug/L	EPA 608
Endosulfan sulfate	0.1	ug/L	EPA 608
Endrin	0.1	ug/L	EPA 608
alpha-BHC	0.025	ug/L	EPA 608
beta-BHC	0.05	ug/L	EPA 608
delta-BHC	0.05	ug/L	EPA 608
gamma BHC (Lindane)	0.025	ug/L	EPA 608
Heptachlor	0.02	ug/L	EPA 608
Heptachlor Epoxide	0.02	ug/L	EPA 608
Hexachlorobenzene	0.1	ug/L	EPA 608
Hexachlorocyclopentadiene	0.1	ug/L	EPA 608
Methoxychlor	0.2	ug/L	EPA 608
Metolachlor (Dual)	0.25	ug/L	EPA 608
Metribuzin (Sencor)	0.1	ug/L	EPA 608
PCB-1016	0.5	ug/L	EPA 608
PCB-1221	1	ug/L	EPA 608
PCB-1232	0.5	ug/L	EPA 608
PCB-1242	0.5	ug/L	EPA 608
PCB-1248	0.5	ug/L	EPA 608

PCB-1254	0.5	ug/L	EPA 608
PCB-1260	0.5	ug/L	EPA 608
Picloram (Tordon)	0.8	ug/L	EPA 615
Propachlor (Ramrod)	0.25	ug/L	EPA 608
Propazine (Milogard)	0.3	ug/L	EPA 608
Silvex, as acid (2,4,5-TP)	0.4	ug/L	EPA 615
Simazine	0.3	ug/L	EPA 608
Toxaphene	2	ug/L	EPA 608
2,4-D as acid	0.8	ug/L	EPA 615
2,4,5-T as acid	0.4	ug/L	EPA 615

TABLE 4.7-4

ROUTINE RADIOLOGICAL PARAMETERS

PARAMETER	REPORTING LIMIT	REPORTING UNIT	ANALYTICAL METHOD
Gross alpha	1	pCi/L	EPA 900.0
Gross beta	4	pCi/L	EPA 900.0
Tritium	350	pCi/L	SM 306
Chromium-51	52	pCi/L	EPA 600/4-80-032
Manganese-54	4	pCi/L	EPA 600/4-80-032
Iron-59	8	pCi/L	EPA 600/4-80-032
Cobalt-57	3	pCi/L	EPA 600/4-80-032
Cobalt-58	4	pCi/L	EPA 600/4-80-032
Cobalt-60	11	pCi/L	EPA 600/4-80-032
Zinc-65	8	pCi/L	EPA 600/4-80-032
Zirconium-95	6	pCi/L	EPA 600/4-80-032
Molybdenum-99	5	pCi/L	EPA 600/4-80-032
Ruthenium-103	10	pCi/L	EPA 600/4-80-032
Ruthenium-106	55	pCi/L	EPA 600/4-80-032
Indium-111	11	pCi/L	EPA 600/4-80-032
Iodine-123	12	pCi/L	EPA 600/4-80-032
Iodine-131	5	pCi/L	EPA 600/4-80-032
Cesium-134	5	pCi/L	EPA 600/4-80-032
Cesium-137	7	pCi/L	EPA 600/4-80-032
Barium-140	10	pCi/L	EPA 600/4-80-032
Ytterbium-169	28	pCi/L	EPA 600/4-80-032
Iridium-192	5	pCi/L	EPA 600/4-80-032

4.8 Taxonomic Determinations

Appendix B provides a detailed description of the taxonomic procedures used in this program. Macroinvertebrate samples are identified to the lowest practicable taxonomic level utilizing literature specific to the Kansas fauna or the most appropriate, up-to-date taxonomic literature available. Voucher specimens of unusual or newly discovered species or rarely encountered taxa are added to the reference collection on an ongoing basis. Opinions of outside taxonomic experts are solicited as needed. -Samples are retained for a minimum of two years following specimen identification. Historical data may be adjusted to accommodate ongoing changes in the scientific nomenclature.

TABLE 4.8-1

LITERATURE FOR SPECIFIC TAXONOMIC GROUPS

Turbellaria	(Kenk 1972)
Hirudinea	(Klemm 1982)
Oligochaeta	(Hiltunen and Klemm 1980)
Tubificidae	(Stimpson *et al.* 1982)
Bivalvia	(Murray and Leonard 1962; Burch 1973; Oesch 1984; Couch 1998)
Gastropoda	(Leonard 1959; Burch 1982)
Crustacea	(Williams and Leonard 1952; Hobbs 1972; Holsinger 1972; Capelli and Capelli 1980; Page 1985; Pflieger 1987, 1996; Ghedoti 1998)
Isopoda	(Williams 1972)
Coleoptera	(Brown 1972; Wolfe and Matta 1981; Matta and Peterson 1985; Young 1985)
Diptera	(Boesel 1974; Beck 1976; Fredeen 1981; Soponis and Russel 1982; Ferrington 1983; Fittkau and Roback 1983; Boesel 1985; Roback 1985; Gelhaus 1986; Grodhaus 1987)
Ephemeroptera	(Burks 1953; Lewis 1974; Edmunds *et al.* 1976; Bednarik and McCafferty 1979)
Hemiptera	(Hungerford 1954; Bennett and Cook 1981)
Odonata	(Needham and Westfall 1954; Trottier 1969; Westfall and Tennessen 1979; Cannings 1981; Garrison 1981; Huggins and Harp 1985)
Plecoptera	(Stark and Gaufin 1976; Stewart and Stark 1984; Zwick 1984; Huggins 1987)
Trichoptera	(Wiggins 1977; Schuster and Etnier 1978; Hamilton and Gelhaus 1981; Schmude and Hilsenhoff 1986)

TABLE 4.8-2

GENERAL TAXONOMIC LITERATURE

AFreshwater Algae of the United States, (Smith 1950)
ACharophytes of North America, (Wood 1967)
AAlgae of the Western Great Lakes Area, (Prescott 1962)
"Guide to the Freshwater Invertebrates of the Midwest" (Huggins *et al.* 1981)
"Aquatic Insects and Oligochaetes of North and South Carolina" (Brigham *et al.* 1982)
"Aquatic Insects of Wisconsin" (Hilsenhoff 1981)
"Aquatic Insects of North America" (Merrit and Cummins 1984)
"Freshwater Invertebrates of the United States" (Pennak 1989)
ACommon and Scientific Names of Fishes from the United States and Canada@ (Robbins et al. 1991)
AAmphibians and Reptiles in Kansas, (Collins 1993)
AFishes in Kansas, (Cross and Collins 1995)
ACommon and Scientific Names of Aquatic Invertebrates from the United States and Canada: Mollusks, (Turgeon *et al.* 1998)

4.9 Internal Procedures for Assessing Data Precision, Bias, Representativeness and Comparability

4.9.1 Instrument Calibration and Standardization

At monthly intervals, the performance of all thermometers used in the field is checked against a reference thermometer traceable to the National Institute of Standards and Technology (NIST). Before leaving for the field, monitoring staff also check pH, DO and conductivity meters for normal operation. The pH meter is standardized in the field, immediately prior to use, using NIST-traceable pH buffer solutions (Appendix B). Conductivity meter/cell performance is evaluated by periodically measuring the resistance of a KCl solution standard and redetermining the cell constant (APHA 1975). Dissolved oxygen meters are air-calibrated in the field according to the manufacturer's instructions. When using the DO meter, a water sample is always collected to check meter performance against the results of a Winkler titration (Appendix B). Field instruments must meet manufacturer's performance specifications. If instrument readings begin to drift significantly, more frequent calibrations must be performed or corrective action procedures must be invoked (section 4.11).

4.9.2 Procedural Blanks

In assessing water chemistry, the possibility of sample contamination during sample preparation, storage and analysis is evaluated through the use of procedural blanks, prepared with ASTM Type-I quality water and subjected to the same treatment as the water quality samples. Contamination is an especially important consideration when sampling for trace metals, as concentrations of these parameters in surface water are frequently less than 1.0 ug/L and may be augmented artificially through exposure to airborne particulate matter, etc. When preparing procedural blanks, a complete set of sampling containers is selected at random, filled with ASTM Type-I quality water under field conditions, and sealed, transported, stored and analyzed along with the other field samples. If the QA/QC limits of section 2, paragraph 1, are exceeded, corrective action procedures are implemented in accordance with section 4.11.

4.9.3 Duplicate, Replicate and Spiked Samples

Routine QC measures employed during physicochemical monitoring activities include the collection of duplicate samples and the preparation of spiked samples. Duplicate samples are collected from a minimum of one site per UAA. At least three times each year, a duplicate sample is spiked with known concentrations of selected parameters and submitted to KHEL in "blind" fashion. These spiked samples are prepared under the supervision of the section chief (or designee) in the relatively controlled environment of the BOW Monitoring Lab using volumetric glassware and standard solutions provided by KHEL or reference samples provided by EPA, the U.S. Geological Survey, or reputable commercial vendors. The corrective action procedures described in section 4.11 are invoked if data precision or data bias fall outside the control limits established in section 2.

Replicate biological samples are collected from no less than 10 percent of the sites subjected to biological sampling. The collection protocol involves at least two individuals (or two groups of individuals) working simultaneously within the same general surface water reach (Appendix B). During the collection of replicate samples, each worker must take great care to avoid sampling areas which have already been sampled or otherwise disturbed by other members of the field crew. If the precision level indicated by replicate sampling fails to meet the QC requirements of section 2, paragraph (1), the program manager and section chief invoke the corrective action measures described in section 4.11.

Taxonomic determinations are validated by comparing the list of taxa from a particular sample to historical listings for the waterbody or river basin of interest. Determinations may also be checked against the KBS inventory of aquatic macroinvertebrate taxa known to occur in Kansas. Rare or unusual specimens may be compared to specimens in the agency reference collection and, if necessary, submitted to outside experts for confirmation. Annual program audits conducted by the

section chief evaluate, among other things, the taxonomic proficiency of program staff. If the accuracy of specimen identification fails to meet the requirements of section 2, paragraph (1), corrective action measures are initiated (section 4.11).

4.9.4 Preventative Maintenance

Periodic inspection and routine maintenance of field and laboratory equipment is necessary to minimize malfunctions which could result in the loss of data or disruption of program activities. Field instrumentation must be inspected prior to use and calibrated at intervals recommended by the manufacturer. Equipment maintenance logs must be maintained for all pH, DO and conductivity meters. Instrument malfunctions must be reported to the program manager as soon as possible to expedite necessary repairs or the acquisition of new equipment. Biological sampling equipment, such as D-frame nets and hip and chest waders, and microscopes and illuminators used in specimen identification, must also be inspected periodically and repaired or replaced if necessary.

All field vehicles must be maintained in reliable condition and kept essentially free of trash, debris or other materials that could significantly increase the risk of sample contamination. Entries must be made in the vehicle log upon completion of each field trip. All vehicle malfunctions must be reported as soon as possible to expedite necessary repairs or the acquisition of a replacement vehicle.

4.9.5 Safety Considerations

Attention to job safety protects the health and well-being of program staff and helps maintain a work atmosphere which ultimately enhances data quality and consistency. Program staff must be familiar with proper precautionary measures and the use of available safety equipment prior to assuming field duties. All vehicles used in the surface water use designation program must be maintained in proper operating condition and equipped with first aid kits, fire extinguishers, spare tires and tire changing equipment, rain gear, orange or red safety vests, road reflectors and/or flares, and operable flashlights. Monitoring staff are encouraged to check out cellular phones from BOW clerical staff on a routine basis, in the event of vehicle mishaps, medical problems, or other emergencies in the field. The use of a cellular phone is especially encouraged when traveling alone, conducting overnight sampling runs, or traveling during periods of potentially severe weather. Additional safety considerations are presented in the SOPs accompanying (or referenced within) this QA management plan.

4.9.6 In-house Audits

The section chief conducts annual audits of all field, analytical, and taxonomic procedures. Each audit is comprised of (1) a system audit, consisting of a qualitative, onsite review of QA/QC methods

and physical apparatus and facilities for monitoring, measurement, and specimen identification and (2) a performance audit, in which a quantitative assessment is made of the efficiency and reliability of sampling, habitat assessment, and taxonomic procedures. During system audits, program staff are required to demonstrate a proper understanding of the requirements imposed by the QA management plan and accompanying SOPs. During performance audits, staff are required to conduct field measurements, habitat assessments, and/or taxonomic determinations in the presence of the section chief, report measured values for stream temperature, pH, electrical conductivity, and DO concentration that fall within five percent of those established by the section chief, and report measured values for selected habitat and community metrics that fall within twenty percent of those established by the section chief (in possible consultation with other qualified staff or outside experts). Should reported values fall outside the stipulated control limits, the section chief, program manager and field staff initiate corrective actions as described in section 4.11. The section chief is responsible for maintaining a log of audit results and for summarizing these results in annual QA reports to the divisional QA officer (section 4.13).

4.10 External Procedures for Assessing Data Precision, Bias, Representativeness and Comparability

At the discretion of the section chief, bureau director, or divisional QA officer, the surface water use designation program may participate in independent performance/system audits or in inter-laboratory or interagency sample comparison programs or reference sample programs. Participation in such activities promotes scientific peer review and enhances the technical integrity and overall credibility of the program.

4.11 Corrective Action Procedures for Out-of-Control Situations

4.11.1 Equipment Malfunction

Any equipment malfunction discovered by staff during routine sampling, testing or taxonomic activities, or during an internal or external performance audit, must be reported immediately to the program manager. The program manager is responsible for appraising the scope and seriousness of the problem and, if necessary, for determining whether the equipment item should be repaired or replaced. The program manager also is responsible for ensuring that backup equipment is available for all critical field and taxonomic activities. This includes arranging for a backup vehicle in advance of any mechanical problems or mishaps that might render the program's regular vehicle inoperable for an extended period.

4.11.2 Sample Contamination

Blank concentrations outside the control limits established in section 2, paragraph (1), detract from the quality and credibility of surface water chemistry data and must be resolved in a timely manner. In instances where the source of the contamination is unknown, the program manager shall initiate an investigation to determine whether the problem is of likely field or laboratory origin. Field contamination problems may result from improper sample collection techniques, exposure to contamination sources at the sampling site or within the vehicle used to transport the samples, or other causes. Laboratory problems may result from contaminated water supplies or reagents, contaminated glassware, or some less conspicuous problem. Program staff are expected to work closely with KHEL personnel to identify and eliminate contamination sources. Persistent problems may trigger a program audit by the section chief and, ultimately, result in the removal of questionable data from the use designation database.

4.11.3 Data Precision/Bias Problems

Should data accuracy fail to meet the requirements of section 2, paragraph (1), the program manager shall initiate an investigation to determine the cause of the problem. The program manager shall work closely with staff in this endeavor and in the selection and implementation of appropriate corrective measures. Persistent problems may trigger a program audit by the section chief, result in the disqualification of a substantial amount of field and/or laboratory data, or invoke other remedial responses (e.g., an independent audit).

4.11.4 Staff Performance Problems

Should an employee have difficulty with a given work procedure, as determined by an internal or independent performance audit, an effort shall be made by the program manager to identify the scope and seriousness of the problem, to identify any data effected by the problem, and to recommend to the section chief an appropriate course of corrective action. All questionable data are either flagged within the computer database or, at the discretion of the section chief, deleted from the database. Possible corrective actions include further in-house or external training for the employee, a reassignment of work duties, or modification of the work procedure.

4.12 Data Management

All water chemistry and bacteriological data are handled in an orderly and consistent manner. Time and date of sample collection, monitoring site location, and other basic information are recorded on

standardized sample submission forms (Appendix B). Copies of these forms are retained by

sampling staff and routed to the program manager for archiving; original forms are submitted to KHEL along with the samples. Upon completion of the laboratory analyses, the KHEL computer automatically downloads data to the Kansas Water Database, which is accessed through the KDHE IBM AS-400 computer system. This database is supported and backed-up daily by the KDHE Office of Information Systems (OIS).

Water chemistry and bacteriological data reported by KHEL are archived by BOW in hard copy format. These data are carefully reviewed by staff for obvious errors or omissions. Information derived from QC samples (duplicates, spikes, blanks, etc.) are subject to particularly thorough review. With the approval of the section chief, data that are deemed inaccurate, or grossly unrepresentative, are purged from the electronic database. Laboratory data are electronically downloaded onto the EPA STORET database on a monthly basis. Field data for temperature, pH and DO are loaded onto electronic spreadsheets, checked for obvious errors or omissions, and downloaded onto STORET each month. Redundant forms of data storage and backup (e.g., EPA STORET system, Kansas Water Database, KHEL tape files, BOW hard copy files) help to ensure the long-term integrity and availability of the program data.

All biological data are also handled in an orderly and consistent manner. Time and date of sample collection, surface water monitoring location, and other basic field information are recorded on standardized forms; similarly, taxonomic data, biological community metrics/scores, and habitat assessments are recorded on standardized forms (Appendix B). The original forms are carefully reviewed for obvious errors or omissions and are subsequently filed in a secured location for future reference.

Macroinvertebrate data (other than unionid mussel data) are manually added to a biological database maintained on an IBM AS-400 minicomputer supported by the agency's Office of Information Systems (OIS). This relational database (QUERY) also contains station identification headers, sample collection date/time files, KBS codes for individual macroinvertebrate species and other taxonomic designations, pollution tolerance values and other rating systems for calculation of biotic indices, and other supporting information. Custom program screens have been designed by OIS to facilitate database access and the viewing, validation and editing of data. The database is backed-up by OIS on a daily basis. Transfers of raw data may be accomplished by downloading selected portions of the database to ASCI or other file formats. Several customized reporting formats have been designed by OIS. These allow the raw data to be sorted or restricted based on station location, date of sample collection, or KBS code, with or without associated station header information, metric values, and other supporting information. Retrievals may be printed, viewed, or downloaded onto ASCI files. Calculated values for various macroinvertebrate community metrics also are maintained on a personal computer (QUATTRO PRO) spreadsheet. Calculated values may be retrieved and

reported in various formats or subjected to basic statistical analysis. These spreadsheets are stored on hard drives and backed up on CD ROM every two months.

Fish, unionid mussel, and biological habitat databases are likewise maintained on separate (QUATTRO PRO) spreadsheets and stored in hard and floppy disc formats. Field and laboratory recording forms, field notes, and other written records are filed and kept indefinitely (Appendix B).

4.13 Quality Assurance Reporting Procedures

End-of-year program evaluations shall be conducted by the section chief and a written report submitted to the bureau director and divisional QA officer by February 15 of the following year. The program manager shall cooperate fully in the evaluation of QA/QC performance and make available all records pertaining to the precision, bias, representativeness and comparability of the monitoring data gathered during the evaluation period. Program evaluations submitted by the section chief shall indicate when, how, and by whom the evaluation was conducted, the specific aspects of the program subjected to review, a summary of significant findings, and technical recommendations for necessary corrective actions. The section chief is expected to discuss the reported findings with the program manager and other program personnel.

Section 5

REVIEW AND REVISION OF PLAN

To ensure that QA/QC activities meet the evolving needs of the surface water use designation program and remain true to the goals established in section 2, all portions of this plan must be reviewed on a regular basis. At approximately yearly intervals, this plan and its appended SOPs shall be carefully critiqued by program staff, the program manager, and the section chief. Necessary revisions shall be formulated, and concurrences obtained from the bureau director and the divisional QA officer.

These review activities normally will occur following the completion and submission of the annual program reports in February. However, revisions to the program QA management plan and its accompanying SOPs may be implemented at any time, based on urgency of need or staff workload considerations. An updated hard copy of the management plan and accompanying SOPs shall be maintained in the BOW library and made available to all program staff and other interested employees.

APPENDIX A

INVENTORY OF FIELD, OFFICE AND LABORATORY EQUIPMENT

KANSAS SURFACE WATER USE DESIGNATION PROGRAM

INVENTORY OF FIELD AND LABORATORY EQUIPMENT

I. VEHICLE

A. Full size van or other vehicle capable of accommodating needed equipment

II. FIELD EQUIPMENT AND RELATED SUPPLIES

A. Stainless steel self-filling sampling bucket (1 gallon)

B. Stainless steel pail (1 gal)

C. Stainless steel funnel

D. Rope, cotton fiber, 75-ft length with snap swivel

E. Coleman ice chests (100-qt capacity)

F. Fluorescent orange safety vests

G. First aid kit

H. Fire extinguisher

I. Road reflectors and/or flares

J. Flashlights

K. Cellular telephone

L. Rubber rain coats

M. Hand sanitizer solution

N. Camera (digital)

O. Plastic sample storage tubs

P. Wooden sample storage crates

Q. Clipboards (for maps, field recording sheets, etc.)

R. Glass beakers (100 ml)

S. Hip or chest waders (two pair in use; one spare pair)

T. Sample collection buckets and containers for preserved specimens

U. Formalin solution (37%)

V. Seine 15' x 6' x 1/4" and 6' x 4' x 1/4"

W. Field collection forms

X. Habitat development index forms

Y. Indelible marker

Z. DO bottles (250 ml)

AA. State highway and 1/4" scale county maps

AB. Insect repellant

AC. Stainless steel tongs

AD. GPS units

III. MEASUREMENT APPARATUS

A. Fisher model #15-0778 stainless steel dial scale thermometer (-10 to +110 C)

B. Cole-Parmer model #5996-70 pH meter (analog readout with instruction manual, carrying case,- pH probe, and pH 4, 7, and 10 buffer solutions)

C. Winkler DO measuring kit with reagents #1, #2, and #3 in 250-ml Nalgene plastic

bottles with appended 2-ml plastic dispensing pipettes

D. Conductivity meter

IV. TAXONOMIC EQUIPMENT AND RELATED SUPPLIES

A. Wild binocular microscope

B. Dyonics dual fibre optics, variable intensity light source

C. Glass Petri dishes

D. Sorting trays

E. Biological data forms

F. Ethanol (70-80% with 5% glycerine)

G. Taxonomic references

H. Locking cabinet for reference specimen collection

I. Specimen bottles for reference collection

J. Specimen bottle trays

V. DATA STORAGE AND MANAGEMENT EQUIPMENT

A. Mtech personal computer (Pentium (R) 4 CPU 1.70 Ghz, 512 MB of Ram, and Windows XP)

1. Spreadsheet software: Quattro Pro v8.0, Microsoft Excel 2000, Microsoft Access 2000

2. Word processing: Microsoft Word

3. G.I.S software: Arc View 3.1

B. MAINFRAME (MINICOMPUTER) RESOURCE: -IBM AS-400

1. Database software: Query; Kansas Biological System

APPENDIX B

STANDARD OPERATING PROCEDURES

KANSAS SURFACE WATER USE DESIGNATION PROGRAM

APPENDIX B
TABLE OF CONTENTS

Procedure	Revision No.	Date
CALIBRATION AND MAINTENANCE PROCEDURES FOR FIELD ANALYTICAL EQUIPMENT (GQMP-003)	1	3/31/05
PROCEDURES FOR FIELD ANALYTICAL MEASUREMENTS (GQMP-004)	0	7/1/95
PROCEDURES FOR COLLECTING, PRESERVING, AND TRANSPORTING STREAM WATER SAMPLES (SCMP-005)	2	02/05/07
PROCEDURES FOR COLLECTING, PRESERVING, AND TRANSPORTING LAKE AND WETLAND WATER QUALITY SAMPLES (LWMP-005)	0	7/1/95
CHAIN OF CUSTODY PROCEDURES FOR STREAM WATER SAMPLES (SCMP-006)	0	7/1/95
MAINTENANCE PROCEDURE FOR FIELD SAMPLING EQUIPMENT (SBMP-001)	0	7/1/95
PROCEDURES FOR COLLECTION OF MACROINVERTEBRATE SAMPLES (SBMP-003a)	0	7/1/95
PROCEDURES FOR PREPARATION, IDENTIFICATION, ENUMERATION AND PRESERVATION OF BIOLOGICAL SAMPLES (SBMP-004)	0	7/1/95
PROCEDURES FOR COMPLETION OF HABITAT DEVELOPMENT INDEX FORM (SBMP-005)	0	7/1/95

PROCEDURES FOR CONDUCTING USE ATTAINABILITY ASSESSMENTS FOR WATER SUPPLY USES: AGRICULTURAL WATER SUPPLY (IRRIGATION, LIVESTOCK WATERING), DOMESTIC WATER SUPPLY, INDUSTRIAL WATER SUPPLY, GROUNDWATER RECHARGE (SWUDP-001)

I. INTRODUCTION

A. Kansas Surface Water Quality Standards (K.A.R. 28-16-28b *et seq.*) define beneficial uses for the State's waters and specify water quality criteria necessary to protect those uses. Designated uses and associated water quality criteria serve to define the water quality management goals for a waterbody. Consequently, it is essential that the beneficial uses assigned to a waterbody accurately reflect uses that are attainable. Procedures for conducting use attainability analyses (UAA) are necessary to consistently designate appropriate beneficial uses in waters of the State.

B. The purpose of this Standard Operating Procedure (SOP) is to establish uniform procedures for conducting and reporting the results of UAAs pertaining to the following uses:

1. Agricultural Water Supply

   a. Irrigation

   b. Livestock Watering

2. Domestic Water Supply

3. Industrial Water Supply

4. Groundwater Recharge

II. APPLICATION

The procedures contained in or referenced by this SOP shall be applicable to all personnel involved in conducting UAAs.

III. GENERAL GUIDELINES

A. EPA regulations in 40 CFR 131.10(a) require that: Each State must specify

appropriate water uses to be achieved and protected. The classification of the waters of the State must take into consideration the use and value of the water for public water supplies, protection and propagation of fish, shellfish and wildlife, recreation in and on the water, agricultural, industrial, and other purposes including navigation and in 40 CFR 131.10(l)that: Where existing water quality standards specify designated uses less than those which are presently being attained, the State shall revise its standards to reflect the uses actually being attained.

B. The procedures used to assess beneficial use attainability and to classify waters for protection in K.A.R. 28-16-28b *et seq*. are shown below for each beneficial use. These procedures include quantitative measures and qualitative guidelines which are conducted both in the field and at the desktop level.

C. The water quality standards regulations (40 CFR 131.10(g)) define a UAA as a structured scientific assessment of the factors affecting the attainment of the use, which may include physical, chemical, biological, and economic factors. These regulations state: "States may remove a designated use[1] which is *not* an existing use[2], as defined in Sec. 131.3, or establish subcategories of a use if the State can demonstrate that attaining the designated use is not feasible because:

1. Naturally occurring pollutant concentrations prevent the attainment of the use; or

2. Natural, ephemeral, intermittent or low flow conditions or water levels prevent the attainment of the use, unless these conditions may be compensated for by the discharge of sufficient volume of effluent discharges without violating State water conservation requirements to enable uses to be met; or

3. Human caused conditions or sources of pollution prevent the attainment of the use and cannot be remedied or would cause more environmental damage to correct than to leave in place; or

4. Dams, diversions, or other types of hydrologic modifications preclude the attainment of the use, and it is not feasible to restore the water body to its

---

1 Designated uses are those uses specified in Water Quality Standards for each waterbody or segment whether or not they are actually being attained.

2 Existing uses are those uses actually attained in the waterbody on or after November 28,1975, whether or not they are designated in the water quality standards.

original condition or to operate such modification in a way that would result in the attainment of the use; or

5. Physical conditions related to the natural features of the water body, such as the lack of a proper substrate, cover, flow, depth, pools, riffles, and the like, unrelated to water quality, preclude attainment of aquatic life protection uses; or

6. Controls more stringent than those required by sections 301(b)[3] and 306[4] of the Act would result in substantial and widespread economic and social impact."

D. EPA regulations regarding use attainability studies further state in 40 CFR 131.10(j): "A State must conduct a use attainability analysis as described in Sec. 131.3(g) whenever:

1. The State designates or has designated uses that do not include the uses specified in section 101(a)(2)[5] of the Act, or

2. The State wishes to remove a designated use that is specified in sections 101(a)(2) of the Act or to adopt subcategories of uses specified in section 101(a)(2) of the Act which require less stringent criteria."

and in 40 CFR 131.10(h) that: "States may not remove designated uses if:

1. They are existing uses, as defined in Sec. 131.3, unless a use requiring more stringent criteria is added; or
2. Such uses will be attained by implementing effluent limits required under sections 301(b) and 306 of the Act and by implementing cost-effective and reasonable best management practices for nonpoint source control."

E. If a use is existing, it must be assigned. If a use is not existing, a determination whether the use is attainable and what sub-use should be assigned is made.

---

3 Section 301(b) refers to Effluent Limitations.
4 Section 306 refers to National Standards of Performance.
5 Section 101(a)(2) states: " It is the national goal that wherever attainable, an interim goal of water quality which provides for the protection and propagation of fish, shellfish, and wildlife and provides for recreation in and on the water be achieved by July 1, 1983."

A UAA (as defined by EPA) is performed when a 101(a)(2) use (recreation, aquatic life support, or food procurement) is under consideration. If the use is not attainable, a determination must be made that attainment is not feasible because of one of the six 131.10(g) factors. Taken together with use-specific requirements for categorization into subclasses, these steps outline Kansas' procedures for assigning beneficial uses.

F. EPA's water quality standards regulations at 40 CFR 131.10 and the Water Quality Standards Handbook (USEPA, 1994) discuss use attainability analysis in the context of being necessary to remove or not designate a use specified by 101(a)(2) of the Clean Water Act. In Kansas the 101(a)(2) uses are aquatic life support, recreation, and food procurement. However, for the purpose of this document, those procedures used for designation of *all* beneficial uses in K.A.R. 28-16-28b *et seq.*, including the 101(a)(2) uses, will collectively be referred to as use attainability analyses.

IV. DEFINITIONS

Designated uses of stream segments shall be those defined in K.S.A. 82a-2001(c) (K.A.R. 28-16-28d(b), and amendments thereto. Designated uses of surface waters other than stream segments shall be defined as follows:

1. Agricultural water supply use• [K.A.R. 28-16-28d (a) (1) (A, B)] means the use of surface waters other than stream segments for agricultural purposes, including the following:

   (A) Irrigation, which means the withdrawal of surface waters other than stream segments for application onto land; and

   (B) Livestock watering, which means the provision of surface waters other than stream segments to livestock for consumption.

2. Domestic water supply use [K.A.R. 28-16-28d (a) (3)] means the use of surface waters other than stream segments, after appropriate treatment, for the production of potable water.

3. Industrial water supply use [K.A.R. 28-16-28d (a) (6)] means the use of surface waters other than stream segments for nonpotable purposes by industry, including withdrawals for cooling or process water.

4. Groundwater recharge use [K.A.R. 28-16-28d (a) (5)] means the use of surface waters other than stream segments for replenishing fresh or usable groundwater resources. This use may involve the infiltration and percolation of surface waters other than stream segments through sediments and soils or the direct injection of surface waters other than stream segments into

underground aquifers.

V. WATERBODY SELECTION AND COORDINATION

A. The selection of specific waterbodies for which UAAs will be performed will be determined by the Watershed Planning, Monitoring and Assessment Section (WPMAS), Bureau of Water, Division of Environment, KDHE.

B. The coordination for scheduling and conducting the actual UAAs will be accomplished by the Use Assessment Unit staff. A schedule will be prepared and transmitted to Bureau of Water WPMAS Section Chief at the beginning of each year.

C. An activity leader (Environmental Scientist II) will be assigned to perform the necessary coordination and to conduct or oversee the UAA.

VI. PREPARATION FOR UAA

A. The UAA activity leader shall review all applicable files, databases and maps in order to become thoroughly familiar with the waterbody to be inspected and to determine what sampling will be accomplished.

1. For the irrigation use (agricultural water supply), the WIMAS (Water Information Management and Analysis System) GIS (Geographic Information System) database shall be consulted to determine the existence of surface or alluvial aquifer groundwater appropriations for the purpose of irrigation.
2. For the livestock watering use (agricultural water supply), the WIMAS GIS database shall be consulted to determine the existence of surface or alluvial aquifer groundwater appropriations for the purpose of livestock watering. Bureau of Water feedlot records shall be consulted to determine the existence of concentrated animal facilities which might have access to the waterbody for the purpose of obtaining drinking water. United States Geological Survey (USGS) topographic maps and aerial photographs (if available) shall be reviewed for the presence of likely areas of small feedlots not required to hold permits, winter feeding operations, or other likely points of livestock access to the waterbody.

3. For the domestic water supply use, the WIMAS GIS database shall be consulted to determine the existence of surface or alluvial aquifer groundwater appropriations for the purpose of production of potable water. Public Water Supply Section (KDHE, BOW) records shall be reviewed for

the same purpose.

4. For the industrial water supply use, the WIMAS GIS database shall be consulted to determine the existence of surface or alluvial aquifer groundwater appropriations for the purpose of industrial water supply.

5. For the groundwater recharge use, available geological information (USGS, Kansas Geological Survey [KGS]) shall be reviewed to determine the presence of alluvial aquifers seeps or springs in or near the waterbody and whether the waterbody is characterized as a gaining• or losing• stream. The WIMAS GIS database shall be consulted to determine the existence of surface water appropriations for the purpose of aquifer replenishment.

B. The activity leader should determine if there are any specific issues or problems that need to be addressed, any specific information that needs to be obtained, and specific sampling needs to be accomplished during the assessment.

C. Final preparation for the actual assessment should include:

1. Accumulation of appropriate personal safety equipment, assessment tools (credentials, digital camera, assessment forms, global positioning system [GPS] unit), reference material (topographic maps, aerial photos), sampling equipment (sampling bucket and rope, sample containers, chemical fixatives) and field equipment (pH meter, thermometer, specific conductance meter) to be taken on the actual inspection (Appendix A).

   a. The activity leader should refer to applicable SOP's for determining equipment and supply needs; e.g., sample containers and sample preservation (SOP No. SCMP-005, Appendix B)

   b. A checklist is included as Appendix A to assist the activity leader in this process of determining what equipment is needed and assembling it.

2. Preparation of field sheets and sample tags for documentation and identification of the samples to be collected during the inspection (Appendices C and D).

3. Determination of how samples will be shipped or transported from the field location to the laboratory for analysis (SOP No. SCMP-006, Appendix B).

VII. UAA FIELD ASSESSMENT PROCEDURES

A. The number of sites to be assessed on a given waterbody will be determined prior to commencement of field activities. For a lake or wetland, one site may be adequate to characterize existing or potential uses. Stream or river UAAs will generally have more sites (a minimum of three) due to the possibility of anomalous habitat conditions at any given access point.

B. Assessment sites shall be designated for each UAA and clearly marked on Kansas Department of Transportation (KDOT) county maps or 1:24,000 (7.5 minute series) USGS topographic maps. When possible, GPS coordinates shall be taken on-site and recorded on field forms. GPS readings are required at all assessment sites not clearly indicated as bridge crossings on topographic maps and are strongly recommended for all other sites as well. GPS procedure is documented in SOP No. SCMP-001 (Appendix B).

C. If access to the waterbody is to be made on private property, landowner or resident permission shall be secured prior to access.

D. Narrative UAA site assessments are to be clearly recorded, either by electronic (minicassette recorder) or written means, at each assessment site. Recording observations before moving to the next assessment site is necessary to eliminate risk of mistakes or confusion regarding existing or attainable uses among the multiple sites assessed.

The written assessment shall include waterbody assessed, legal location, GPS coordinates, field physical and chemical data, photographic exposure information, stream width, depth and flow estimations, habitat types present, existing uses actually observed, observations of unusual conditions such as algae blooms, dead fish or unusual odors, streambank water diversions or alluvial wells (located within 50 feet of the waterbody), observations of aquatic life such as fish or mussels, observations of semiaquatic life such as amphibians, waterfowl, or furbearers, and indications of human or livestock access (Appendices D-1 through D-6 and SBMP C-1 through C-3, as appropriate to the type of waterbody).

E. At a minimum, chemical and physical water quality measurements shall be made at each site assessed for the following parameters: dissolved oxygen, pH, specific conductance, and temperature. Additional parameters will be measured if pertinent to the support of a particular use (e.g., sulfate, fluoride, and chloride for water supply

uses).

1. Sample collection, preservation, holding, and shipping /transporting will be accomplished following KDHE SOPs SCMP-004 and SCMP-005 (Appendix B).

2. Chain-of-custody will be maintained on all collected samples following current procedures (refer to SOP No. SCMP-006, Appendix B).

F. A photographic record should be made of sites assessed for the UAA. Digital photographs should include an upstream view, downstream view, and any photographs required to document observed or potential uses.

G. Whenever possible, streamside or other local landowners or residents should be interviewed regarding present or past uses of the waterbody. Persons interviewed should be identified by name and legal address in the written assessment.

VIII. USE ASSESSMENT PROCEDURES

A. Irrigation - Waterbodies currently used for the withdrawal of surface water for application onto land, or which were used for this purpose on or after November 28, 1975, shall be considered to have irrigation as an existing use. This information is obtained from water rights appropriations filed with the Kansas Division of Water Resources (DWR), onsite visual observation, or interviews with streamside landowners or other knowledgeable individuals.

1. The domestic use provision of the Kansas Water Appropriation Act (K.S.A. 82a-701(c), K.S.A. 82a-705, K.S.A. 82a-705a) effectively makes all waters of the state available for household purposes, livestock and domestic animal watering, and irrigation of up to two acres without the need for a formal appropriation right. This provision applies to both surface and groundwater statewide (there are no closed waters) subject only to the provisions that the use does not conflict with senior water rights or result in complete cessation of flow in surface streams. Consequently, all classified waterbodies for which available chemical water quality data indicate naturally occurring levels of fluoride averaging less than two times the irrigation criteria, shall be considered to have irrigation as an attainable use.

Note: These data may be available from KDHE's Bureau of Water or may be obtained independently by the evaluator. If the latter alternative is chosen, all water samples must be

analyzed by a laboratory certified by KDHE to conduct fluoride analyses (K.S.A.65-171*l*). Sample collection and analysis shall be accomplished following standard methods described in *Standard Methods for the Examination of Water and Wastewater, 17th Ed.*, 1989 (or later edition), Washington DC: American Public Health Association.

2. Waterbodies in direct contact with alluvial aquifers shall be assigned irrigation as an existing use if the aquifer is used as an irrigation source, or was used for this purpose on or after November 28, 1975, (based on information obtained from water rights appropriations filed with DWR, onsite visual observation, or interviews with streamside landowners or other knowledgeable individuals).

3. Because of the domestic use provision of the Kansas Water Appropriation Act (as explained above), waterbodies in direct contact with alluvial aquifers for which available chemical water quality data indicate naturally occurring levels of fluoride averaging less than two times the irrigation criteria, shall be considered to have irrigation as an attainable use.

B. Livestock Watering - The livestock watering beneficial use shall be considered existing when indications of such use are evident, or if the waterbody was used for this purpose on or after November 28, 1975 (based on information obtained from water rights appropriations filed with DWR, onsite visual observation, or interviews with streamside landowners or other knowledgeable individuals).

1. Because of the domestic use provision of the Kansas Water Appropriation Act –(as explained above), livestock watering shall be considered an attainable use if available chemical water quality data indicate naturally occurring levels of sulfate and fluoride averaging less than two times the livestock watering criteria and the waterbody meets the criteria for classification set forth in K.A.R. 28-16-28d(c), which state:

Surface waters shall be classified as follows:

1. Classified stream segments shall be those stream segments that meet the criteria for classification set forth in K.A.R. 28-16-28d(c)(1), which describes classified streams as follows:

A. Streams which have the most recent 10-year median flow of equal to or in excess of 1 cubic foot per second (1.0 cfs) based on data collected and evaluated by the United States geological survey.

B. Streams actually inhabited by threatened or endangered aquatic species listed in rules and regulations promulgated by the Kansas Department of Wildlife, Parks and Tourism or the U.S. Fish and Wildlife Services.

C. Streams which are at the point of discharge and downstream from such point where the Department has issued a National Pollutant Discharge Elimination System permit other than a permit for a confined feeding facility.

D. A stream shall be classified if scientific studies conducted or accepted -by the department show during periods of flow less than one cubic foot per second (< 1.0 cfs) stream segments provide important refuges for aquatic life and permit biological recolonization of intermittently flowing segments and a cost/benefit analysis indicates the benefits of classifying the stream outweigh the costs of classifying the stream.

2. Classified lakes shall be all lakes owned by federal, state, county, or municipal authorities and all privately owned lakes that serve as public drinking water supplies or that are open to the general public for primary or secondary contact recreation.

3. Classified wetlands shall be the following:

(A) All wetlands owned by federal, state, county, or municipal authorities;

(B) all privately owned wetlands open to the general public for hunting, trapping, or other forms of secondary contact recreation; and

(C) all wetlands classified as outstanding national resource waters or exceptional state waters, or designated as special aquatic life use waters according to subsection (d).

Wetlands created for the purpose of wastewater treatment shall not be considered classified wetlands.

4. Classified ponds shall be all ponds owned by federal, state, county, or

municipal authorities and all privately owned ponds that impound water from a classified stream segment as defined in paragraph (c)(1).

5. Classified waterbodies in direct contact with alluvial aquifers shall be assigned livestock watering as an existing use if the aquifer is used as a livestock watering source, or was used for this purpose on or after November 28, 1975, (based on information obtained from water rights appropriations filed with DWR, onsite visual observation, or interviews with streamside landowners or other knowledgeable individuals).

6. Because of the domestic use provision of the Kansas Water Appropriation Act (as explained above), classified waterbodies in direct contact with alluvial aquifers for which available chemical water quality data indicate naturally occurring levels of sulfate and fluoride averaging less than two times the livestock watering criteria, shall be considered to have livestock watering as an attainable use.

C. Domestic Water Supply - Waterbodies currently used as a direct source of domestic water supply, or which were used for this purpose on or after November 28, 1975, (based on information obtained from KDHE Bureau of Water, Public Water Supply Section, water rights appropriations filed with DWR, onsite visual confirmation, or interviews with streamside landowners or other knowledgeable individuals) shall be designated as having an existing domestic water supply use.

1. Because of the domestic use provision of the Kansas Water Appropriation Act (as explained above), waterbodies for which available chemical water quality data indicate naturally occurring levels of sulfate, fluoride, and chloride averaging less than two times the domestic water supply criteria, shall be considered to have domestic water supply as an attainable use.

2. Waterbodies in direct contact with alluvial aquifers shall be assigned domestic water supply as an existing use if the aquifer is used as a domestic water supply source, or was used for this purpose on or after November 28, 1975, (based on information obtained from KDHE Bureau of Water, Public Water Supply Section, water rights appropriations filed with DWR, onsite visual observation, or interviews with streamside landowners or other knowledgeable individuals).

3. Because of the domestic use provision of the Kansas Water Appropriation Act (as explained above), waterbodies in direct contact with alluvial aquifers

for which available chemical water quality data indicate naturally occurring levels of sulfate, fluoride, and chloride averaging less than two times the domestic water supply criteria, shall be considered to have domestic water supply as an attainable use.

D. Industrial Water Supply - Waterbodies where existing uses include cooling water, hydroelectric power generation, or nonfood processing water for commercial or industrial activities, or which were used for this purpose on or after November 28, 1975, shall be assigned industrial water supply as an existing use. This information is obtained from water rights appropriations filed with the Kansas Division of Water Resources (DWR) or onsite visual confirmation. Classified waterbodies not currently used for this purpose but which would be considered for appropriation by DWR shall be considered to have industrial water supply as an attainable use.

Waterbodies in direct contact with alluvial aquifers shall be assigned industrial water supply as an existing use if the aquifer is used as an industrial water supply source, or was used for this purpose on or after November 28, 1975, (based on information obtained from water rights appropriations filed with DWR or onsite visual observation). Classified waterbodies contacting aquifers not currently used for this purpose (but which would be considered for appropriation for the purpose by DWR) shall be considered to have industrial water supply as an attainable use.

E. Groundwater Recharge - The groundwater recharge use shall be considered existing when sand, gravel, fractured bedrock, or other unconsolidated substrates are present, when springs or seeps occur in or near the streambed, or if the waterbody is characterized a losing stream based on information obtained from KGS, USGS, or onsite visual observation, or if the waterbody is utilized for injection for aquifer replenishment.

IX. UAA DOCUMENTATION

A. Finalized Use Attainability Assessments will be maintained on file in BOW. UAA findings will be communicated by memorandum to the BOW WPMAS Assessment and Information Unit Leader for inclusion in proposed revisions to the KSWQS surface water registry.

B The finalized UAA file, reviewed and approved by the Environmental Scientist IV and maintained by the Environmental Scientist II, , will contain, at a minimum, the following materials:

1. completed UAA field sheets (Appendix D) including field notes and labeled digital photographs,

2. photocopied KDOT county maps or USGS 1:24,000 (7.5 minute series) topographic maps of the waterbody segment assessed,

3. waterbody physicochemical data - both data obtained during the field assessment and (where available) from USEPA STORET database or other sources,

4. printouts of information obtained from WIMAS, KDHE-PWS, or other databases or sources of information pertaining to the referenced designated uses, and

5. copy of the memorandum to BOW WPMAS Assessment and Information Unit Leader describing the UAA findings.

PROCEDURES FOR CONDUCTING USE ATTAINABILITY ASSESSMENTS FOR AQUATIC LIFE SUPPORT USES: SPECIAL AQUATIC LIFE USE, EXPECTED AQUATIC LIFE USE, RESTRICTED AQUATIC LIFE USE (SWUDP-002)

I. INTRODUCTION

A. Kansas Surface Water Quality Standards (K.A.R. 28-16-28b *et seq.*) define beneficial uses for the State's waters and specify water quality criteria necessary to protect those uses. Designated uses and associated water quality criteria serve to define the water quality management goals for a waterbody. Consequently, it is essential that the beneficial uses assigned to a waterbody accurately reflect uses that are attainable. Procedures for conducting use attainability analyses (UAA) are necessary to consistently designate appropriate beneficial uses in waters of the State.

B. The purpose of this Standard Operating Procedure (SOP) is to establish uniform procedures for conducting and reporting the results of UAAs pertaining to the following uses:

1. Aquatic Life Support

   a. Special Aquatic Life Use

   b. Expected Aquatic Life Use

   c. Restricted Aquatic Life Use

II. APPLICATION

The procedures contained in or referenced by this SOP shall be applicable to all personnel involved in conducting UAAs.

III. GENERAL GUIDELINES

A. EPA regulations in 40 CFR 131.10(a) require that: Each State must specify appropriate water uses to be achieved and protected. The classification of the waters of the State must take into consideration the use and value of the water for public water supplies, protection and propagation of fish, shellfish and wildlife, recreation in and on the water, agricultural, industrial, and other purposes including navigation and in 40 CFR 131.10(l) that: Where existing water quality standards specify designated

uses less than those which are presently being attained, the State shall revise its standards to reflect the uses actually being attained.

B. The procedures used to assess beneficial use attainability and to classify waters for protection in K.A.R. 28-16-28b *et seq.* are shown below for each beneficial use. These procedures include quantitative measures and qualitative guidelines which are conducted both in the field and at the desktop level.

C. The water quality standards regulations (40 CFR 131.10(g)) define a UAA as a structured scientific assessment of the factors affecting the attainment of the use, which may include physical, chemical, biological, and economic factors. These regulations state: "States may remove a designated use[6] which is *not* an existing use[7], as defined in Sec. 131.3, or establish subcategories of a use if the State can demonstrate that attaining the designated use is not feasible because:

1. Naturally occurring pollutant concentrations prevent the attainment of the use; or

2. Natural, ephemeral, intermittent or low flow conditions or water levels prevent the attainment of the use, unless these conditions may be compensated for by the discharge of sufficient volume of effluent discharges without violating State water conservation requirements to enable uses to be met; or

3. Human caused conditions or sources of pollution prevent the attainment of the use and cannot be remedied or would cause more environmental damage to correct than to leave in place; or

4. Dams, diversions, or other types of hydrologic modifications preclude the attainment of the use, and it is not feasible to restore the water body to its original condition or to operate such modification in a way that would result in the attainment of the use; or

5. Physical conditions related to the natural features of the water body, such as the lack of a proper substrate, cover, flow, depth, pools, riffles, and the like,

---

6 Designated uses are those uses specified in Water Quality Standards for each waterbody or segment whether or not they are actually being attained.

7 Existing uses are those uses actually attained in the waterbody on or after November 28,1975, whether or not they are designated in the water quality standards.

unrelated to water quality, preclude attainment of aquatic life protection uses; or

6. Controls more stringent than those required by sections 301(b)[8] and 306[9] of the Act would result in substantial and widespread economic and social impact."

D. EPA regulations regarding use attainability studies further state in 40 CFR 131.10(j): "A State must conduct a use attainability analysis as described in Sec. 131.3(g) whenever:

1. The State designates or has designated uses that do not include the uses specified in section 101(a)(2)[10] of the Act, or

2. The State wishes to remove a designated use that is specified in sections 101(a)(2) of the Act or to adopt subcategories of uses specified in section 101(a)(2) of the Act which require less stringent criteria."

and in 40 CFR 131.10(h) that: "States may not remove designated uses if:

1. They are existing uses, as defined in Sec. 131.3, unless a use requiring more stringent criteria is added; or

2. Such uses will be attained by implementing effluent limits required under sections 301(b) and 306 of the Act and by implementing cost-effective and

---

8 Section 301(b) refers to Effluent Limitations.

9 Section 306 refers to National Standards of Performance.

10 Section 101(a)(2) states: " It is the national goal that wherever attainable, an interim goal of water quality which provides for the protection and propagation of fish, shellfish, and wildlife and provides for recreation in and on the water be achieved by July 1, 1983."

reasonable best management practices for nonpoint source control."

E. If a use is existing, it must be assigned. If a use is not existing, a determination whether the use is attainable and what sub-use should be assigned is made. A UAA (as defined by EPA) is performed when a 101(a)(2) use (recreation, aquatic life support, or food procurement) is under consideration. If the use is not attainable, a determination must be made that attainment is not feasible because of one of the six 131.10(g) factors. Taken together with use-specific requirements for categorization into subclasses, these steps outline Kansas' procedures for assigning beneficial uses.

F. EPA's water quality standards regulations at 40 CFR 131.10 and the Water Quality Standards Handbook (USEPA, 1994) discuss use attainability analysis in the context of being necessary to remove or not designate a use specified by 101(a)(2) of the Clean Water Act. In Kansas the 101(a)(2) uses are aquatic life support, recreation, and food procurement. However, for the purpose of this document, those procedures used for designation of *all* beneficial uses in K.A.R. 28-16-28b *et seq.*, including the 101(a)(2) uses, will collectively be referred to as use attainability analyses.

IV. DEFINITIONS

Designated uses of stream segments shall be those defined in K.S.A. 82a-2001(c), and amendments thereto. Designated uses of surface waters other than stream segments shall be defined as follows:

Aquatic life support use [K.A.R. 28-16-28d (a) (2)] means the use of surface waters other than stream segments for the maintenance of the ecological integrity of lakes, wetlands, and ponds, including the sustained growth and propagation of native aquatic life; naturalized, important, recreational aquatic life; and indigenous or migratory semiaquatic or terrestrial wildlife directly or indirectly dependent on surface waters other than stream segments for survival.

In Kansas, the aquatic life support use is further designated as one of three subcategories: special aquatic live use, expected aquatic life use, and restricted aquatic life use.

1. Special aquatic life use waters [K.A.R. 28-16-28d (a) (2) (A)] means either surface waters other than stream segments that contain combinations of habitat types and indigenous biota not found commonly in the state or surface waters other than stream segments that contain representative populations of threatened or endangered species.

2. Expected aquatic life use waters [K.A.R. 28-16-28d (a) (2) (B)] means surface waters other than stream segments containing habitat types and indigenous biota commonly

found or expected in the state.

3. Restricted aquatic life use waters [K.A.R. 28-16-28d (a) (2) (C)] means surface waters other than stream segments containing indigenous biota limited in abundance or diversity by the physical quality or availability of habitat, due to natural deficiencies or artificial modifications, compared to more suitable habitats in adjacent waters.

V. WATERBODY SELECTION AND COORDINATION

A. The selection of specific waterbodies for which UAAs will be performed will be determined by the WPMAS, Bureau Water, Division of Environment, KDHE.

B. The coordination for scheduling and conducting the actual UAAs will be accomplished by the Use Assessment Program staff. A schedule will be prepared and transmitted to Bureau of Water WPMAS Assessment and Information Unit Leader at the beginning of each year.

C. An activity leader (Environmental Scientist II) will be assigned to perform the necessary coordination and to conduct or oversee the UAA.

VI. PREPARATION FOR UAA

A. The UAA activity leader shall review all applicable files, databases and maps in order to become thoroughly familiar with the waterbody to be inspected and to determine what sampling will be accomplished.

1. The following materials are available from Kansas Department of Wildlife, Parks and Tourism (KDWPT): fishery resource maps and designations, stream survey maps and collection information, and threatened and endangered (T&E) species critical habitat maps.

2. Fish collection records are available from KDWPT stream surveys (published and unpublished records), KDHE (published and unpublished stream fish collection data), Fort Hays State University (FHSU), Kansas Biological Survey Natural Heritage Program, and the University of Kansas Museum of Natural History (UKMNH). Other collection and fishery survey data are available in the references cited below.

3. Unionid mussel collection records and other macroinvertebrate records are available from the Kansas Biological Survey (KBS), KDHE (Kansas Mussel Database), Wichita State University, and Fort Hays State University. Other collection and mussel survey data are available in the references cited below.

1. Records of collection, observation and reproduction of other aquatic and semi-aquatic wildlife, including reptiles, amphibians and birds, are available from Emporia State University, Kansas State University, Kansas Ornithological Society, Kansas Herpetological Society, and Kansas Biological Survey Natural Heritage Program.

B. In the event there is a lack of information concerning existing aquatic communities, it will be necessary to attempt to document the aquatic life community through field sampling.

C. The activity leader, in consultation with the Environmental Scientist IV, should determine if there are any specific issues and/or problems that need to be addressed, any specific information that needs to be obtained, and specific sampling needs to be accomplished during the assessment.

D. Final preparation for the actual inspection should include:

1. Accumulation of appropriate personal safety equipment, assessment tools (credentials, digital camera, assessment forms, global positioning system [GPS] unit), reference material (taxonomic keys for fish and unionid mussels, topographic maps, aerial photos), sampling equipment (sampling bucket and rope, seines, hip boots or chest waders, collection buckets, aquatic D-nets, sample containers, chemical fixatives) and field equipment (pH meter, thermometer, specific conductance meter) to be taken on the actual inspection (Appendix A).

    a. The activity leader should refer to applicable SOP's for determining equipment and supply needs; e.g., sample containers and sample preservation (SOP No. SCMP-005, Appendix B).
    b. A checklist is included in Appendix A to assist the activity leader in this process of determining what equipment is needed and assembling it.

2. Preparation of field sheets and sample tags for documentation and identification of the samples to be collected during the inspection

(Appendices C and D).

3. Determination of how samples will be shipped or transported from the field location to the laboratory for analysis (SOP No. SCMP-006, Appendix B).

VII. UAA FIELD ASSESSMENT PROCEDURES

If there is insufficient information concerning resident aquatic communities, it will be necessary to document the aquatic life community through field assessments. Field assessments must be conducted by a qualified aquatic biologist. A qualified aquatic biologist includes any person with appropriate post-secondary coursework in aquatic biology, aquatic ecology, aquatic invertebrate zoology, ichthyology, and/or limnology combined with field experience in the identification of aquatic and semiaquatic species native to Kansas.

A. Field activities begin with a visual inspection of the targeted waterbody at several randomly selected locations. Those locations deemed most representative of the waterbody are selected for further study. If a site is believed to afford unusual or outstanding biological habitat, it is included as an additional study location even if it is unrepresentative of the waterbody as a whole. This increases the likelihood that rare or unusual biological assemblages will be identified and assigned an appropriate level of protection under the water quality standards. For a lake or wetland, one site may be adequate to characterize existing or potential uses. Stream or river UAAs will generally have more sites (a minimum of three) due to the possibility of anomalous habitat conditions at any given access point. Stream sites (reaches) selected for study should extend in length at least ten times the width of the stream as measured from the high water mark, i.e., top of the stream banks.

B. Assessment sites shall be designated for each UAA and clearly marked on Kansas Department of Transportation (KDOT) county maps or 1:24,000 (7.5 minute series) United States Geological Survey (USGS) topographic maps. When possible, GPS coordinates shall be taken on-site and recorded on field forms. GPS readings are required at all assessment sites not clearly indicated as bridge crossings on topographic maps and are strongly recommended for all other sites as well.

C. If access to the waterbody is to be made on private property, landowner or resident permission shall be secured prior to access (K.S.A. 21-3721).

D. Narrative UAA site assessments are to be clearly recorded, either by electronic

(minicassette recorder) or written means, at each assessment site. Recording observations before moving to the next assessment site is necessary to eliminate risk of mistakes or confusion regarding existing or attainable uses among the multiple sites assessed.

The written assessment shall include waterbody assessed, legal location, GPS coordinates, field physical and chemical data, photographic exposure information, stream width, depth and flow estimations, habitat types present, existing uses actually observed, observations of unusual conditions such as algae blooms, dead fish or unusual odors, streambank water diversions or alluvial wells (located within 50 feet of the waterbody), observations of aquatic life such as fish or mussels, observations of semiaquatic life such as amphibians, waterfowl, or furbearers, and indications of human or livestock access (Appendices D-1 through D-6 and SBMP C-1 through C-3, as appropriate to the type of waterbody).

E. At a minimum, chemical and physical water quality measurements shall be made at each site assessed for the following parameters: dissolved oxygen, pH, specific conductance, and temperature. Additional parameters will be measured if pertinent to the support of a particular use.

1. Sample collection, preservation, holding, and shipping/transporting will be accomplished following the KDHE SOP SCMP-005 (Appendix B).

2. Chain-of-custody will be maintained on all collected samples following current procedures (refer to SOP No. SCMP-006, Appendix B).

F. A photographic record should be made of sites assessed for the UAA. Digital photographs should include an upstream view, downstream view, and any photographs required to document observed or potential uses. Photographs must be marked or catalogued in a manner which indicates the site location and sampling date and what is being shown on each photograph.

G. Whenever possible, streamside or other local landowners or residents should be interviewed regarding present or past uses of the waterbody. Persons interviewed should be identified by name and legal address in the written assessment.

H. Biological community sampling will normally focus on two groups of organisms, fish and molluscs. Numerous fish and mollusc species are listed as T&E or SINC species and will often form the basis for designating a waterbody segment either SALU or

EALU. Aquatic insects may also be collected to assist in designation of the waterbody segment. KDHE SOPs No. SBMP-003 and SBMP-004 (Appendix B) deal with collection, preservation and identification of aquatic insects.

I. Prior to any fish or mollusc collection activities, the activity leader must obtain a scientific collector's permit from KDWPT and, if federally protected species are likely to be encountered, United States Fish & Wildlife Service (USFWS).

J. Fish collection procedures must focus on a multihabitat approach, allowing the sampling of habitats in relative proportion to their local availability. Each sample reach should contain riffle, run and pool habitats, when available. The sample reach should be located away from the influences of point and localized nonpoint sources of pollution, major tributaries and channelized bridge or road crossings. Wadeability and accessibility may ultimately govern the exact placement of the sample reach.

All available habitats at the selected site are sampled exhaustively. Each type of habitat (riffle, run, pool, undercut banks, aquatic vegetation, etc.) is to be sampled extensively until no new species are found in repeated seine hauls. This means at least three consecutive seine hauls with no new species, even under optimal seining conditions. Sub-optimal seining conditions will require more extensive sampling activities, guided by the professional judgment of the fish biologist conducting the sampling. Habitat assessment worksheets are completed to document habitats present and sampled (Appendices D-1 through D-6 and SBMP C-1 through C-3).

K. Fish (except young-of-the-year)) collected within the sample reach must be identified to species (or subspecies) and enumerated. Field identifications are acceptable; however voucher specimens must be retained for laboratory verification, particularly if there is any doubt about the correct identity of the specimen. Specimens that cannot be identified with certainty in the field are preserved in a 10 percent formalin solution and stored in labeled containers for subsequent laboratory identification. A representative voucher collection must be retained for unidentified specimens, very small specimens, and new locality records.

In addition to the unidentified specimen jar, a voucher collection of a subsample of each species identified in the field should be preserved and labeled for subsequent laboratory verification (with the exception of large, readily identifiable species - i.e., carp, flathead catfish, etc., for which photographic documentation will suffice).

Labels should contain (at a minimum) location data (verbal description and legal coordinates), date, collectors' names, and sample identification code or station

number for the particular sampling site.

Voucher specimens and collections will be maintained in the taxonomic reference collection at BOW, KDHE, or forwarded to UKMNH for verification and/or cataloguing in the Division of Fishes collection.

Following the data recording phase of the procedure, specimens that have been identified and enumerated in the field are released on-site to minimize mortality.

L. Identification of fish *must* be conducted by qualified/trained fish taxonomists, familiar with the local and regional ichthyofauna. The accurate identification of each fish collected is essential and species-level identification is required. Questionable records are prevented by: a) requiring the presence of at least one experienced/trained fish taxonomist on every field effort, and b) preserving selected specimens (recommended maximum subsample size of 25 specimens of each species, less for T&E and SINC species [Appendix E]) and those which cannot be readily identified in the field for laboratory verification and/or examination by a qualified fish taxonomist.

M. All fish collection samples received in the laboratory should be tracked by using a sample log-in procedure. Laboratory fisheries professionals *must* be capable of correctly identifying fish to the lowest possible taxonomic level (i.e., species or subspecies) and should have access to suitable regional taxonomic references (books, keys and specimens) to aid in the identification process. Laboratories that do not typically identify fish, or trained fisheries professionals that have difficulty identifying a particular specimen or group of fish, should contact a taxonomic specialist. Taxonomic nomenclature *must* be kept consistent and current. Common and scientific names of fishes are listed in Common and Scientific Names of Fishes from the United States and Canada, 5th Edition. American Fisheries Society, Special Publication 20. Bethesda, Maryland. 1991. (Appendix F).

N. Unionid mussels present at the sample points should also be collected and recorded. Live unionid mussels should be recorded and released on-site (with the exception of voucher specimens). Photographic documentation is adequate for T&E and SINC species (Appendix E), which should also be released on-site. Remnant valves should be collected in numbers proportional to their presence and returned to the laboratory for identification, cataloguing and archiving.

O. Unionid mussels collected within the sample reach must be identified to species (or subspecies) and enumerated. Field identifications of living unionid mussels are

acceptable; however voucher specimens must be retained for laboratory verification, particularly if there is any doubt about the correct identity of the specimen. Live specimens that cannot be identified with certainty in the field are preserved in a 10 percent formalin solution and stored in labeled containers for subsequent laboratory identification. A representative voucher collection must be retained for unidentified specimens, very small specimens, and new locality records.

In addition to the unidentified specimen jar, a voucher collection of a subsample of each species identified in the field should be preserved and labeled for subsequent laboratory verification. Labels should contain (at a minimum) location data (verbal description and legal coordinates), date, collectors' names, and sample identification code or station number for the particular sampling site.

Voucher specimens and collections will be maintained in the taxonomic reference collection at BOW, KDHE, or forwarded to Kansas Biological Survey or UKMNH for verification and/or cataloguing in the collection.

Following the data recording phase of the procedure, specimens that have been identified and enumerated in the field are released on-site to minimize mortality.

P. Identification of unionid mussels *must* be conducted by qualified/trained unionid mussel taxonomists, familiar with the local and regional unionid mussel fauna. The accurate identification of each unionid mussel collected is essential and species-level identification is required. Questionable records are prevented by: a) requiring the presence of at least one experienced/trained unionid mussel taxonomist on every field effort, and b) preserving selected specimens of each species and those which cannot be readily identified in the field for laboratory verification and/or examination by a qualified unionid mussel taxonomist.

Q. All unionid mussel collection samples received in the laboratory should be tracked by using a sample log-in procedure. Laboratory professionals *must* be capable of correctly identifying unionid mussels to the lowest possible taxonomic level (i.e., species or subspecies) and should have access to suitable regional taxonomic references (books, keys and specimens) to aid in the identification process. Laboratories that do not typically identify unionid mussels, or trained professionals that have difficulty identifying a particular specimen or group of unionid mussels, should contact a taxonomic specialist. Taxonomic nomenclature *must* be kept consistent and current. Common and scientific names of unionid mussels are listed in ■Common and Scientific Names of Aquatic Invertebrates from the United States and Canada: Mollusks, 2nd Edition•. American Fisheries Society, Special

Publication 26. Bethesda, Maryland. 1998 (Appendix F).

VIII. USE ASSESSMENT PROCEDURES

A. Aquatic Life Support - This use shall be considered to be existing in all currently classified waterbodies in Kansas and attainable if the waterbody meets the criteria for classification set forth in K.A.R. 28-16-28d(c), which state:

Surface waters shall be classified as follows:

1. Classified stream segments shall be those stream segments that meet the criteria for classification set forth in K.A.R. 28-16-28d(c)(1), which describes classified streams as follows:

(A) Streams which have the most recent 10-year median flow of equal to or in excess of 1 cubic foot per second (1.0 cfs) based on data collected and evaluated by the United States geological survey.

(B) Streams actually inhabited by threatened or endangered aquatic species listed in rules and regulations promulgated by the Kansas Department of Wildlife, Parks and Tourism or the U.S. Fish and Wildlife Services.

(C) Streams which are at the point of discharge and downstream from such point where the Department has issued a National Pollutant Discharge Elimination System permit other than a permit for a confined feeding facility.

(D). A stream shall be classified if scientific studies conducted or accepted by the department show during periods of flow less than one cubic foot per second (< 1.0 cfs) stream segments provide important refuges for aquatic life and permit biological recolonization of intermittently flowing segments and a cost/benefit analysis indicates the benefits of classifying the stream outweigh the costs of classifying the stream.

2. Classified lakes shall be all lakes owned by federal, state, county, or municipal authorities and all privately owned lakes that serve as public drinking water supplies or that are open to the general public for primary or secondary contact recreation.

3. Classified wetlands shall be the following:

(A) All wetlands owned by federal, state, county, or municipal authorities;

(B) all privately owned wetlands open to the general public for hunting, trapping, or other forms of secondary contact recreation; and

(C) all wetlands classified as outstanding national resource waters or exceptional state waters, or designated as special aquatic life use waters according to subsection (d).

Wetlands created for the purpose of wastewater treatment shall not be considered classified wetlands.

4. Classified ponds shall be all ponds owned by federal, state, county, or municipal authorities and all privately owned ponds that impound water from a classified stream segment as defined in paragraph (c)(1).

B. Special aquatic life use - The use shall be considered existing when the waterbody segment is designated as critical habitat for threatened or endangered (T&E) species, or is found to contain T&E or SINC (species in need of conservation) species (Appendix E) during field collection activities.

The use shall be considered attainable when the waterbody falls within the geographic range of T&E or SINC species (Appendix E) and possesses hydrologic and habitat components consistent with the known requirements of these species.

Attainable aquatic life uses may also be assigned based on Habitat Development Index (HDI) scores (SBMP-005, Appendix B and SBMP App. C-2, Appendix D), Macroinvertebrate Biotic Index (MBI) scores, and stream, lake and wetland characterization scores (Appendices D-1 through D-5). As data is gathered over the course of the program, information necessary to characterize waterbodies on the basis of these metrics will be procured. Data necessary to rank waterbodies and assign aquatic life uses based on habitat or biological community characteristics relative to ecoregional reference sites may be acquired and utilized.

C. Restricted aquatic life use - This use shall be assigned to surface waters where indigenous aquatic life is limited in abundance or diversity by the physical quality of the habitat due to natural deficiencies or artificial modifications. Examples of such are concrete lined diversion canals, subterranean aqueducts, and channels so extensively modified that no natural or artificially provided habitat is present.

D. Expected aquatic life use - The use shall be considered attainable when the waterbody meets the State's criteria for classification (K.A.R. 28-16-28d(c)) and existing when the waterbody is classified and aquatic life is present.

IX. UAA DOCUMENTATION

A. Finalized Use Attainability Assessments will be maintained on file in BOW. UAA findings will be communicated by memorandum to WPMAS Assessment and Information Unit leader for inclusion in proposed revisions to the KSWQS surface water registry.

B. The finalized UAA file, reviewed and approved by the Environmental Scientist IV and maintained by the Environmental Scientist II will contain, at a minimum, the following materials:

1. completed UAA field sheets (Appendix D) including field notes and labeled digital photographs,

2. photocopied KDOT county maps or USGS 1:24,000 (7.5 minute series) topographic maps of the waterbody segment assessed,

3. waterbody physicochemical data - both data obtained during the field assessment and (where available) from USEPA STORET database or other sources,

4. printouts of information obtained from WIMAS, KDWPT, or other databases or sources of information pertaining to the referenced designated uses,

5. biological collection field and lab data sheets (Appendices C and D), and

6. copy of the memorandum to WPMAS Assessment and Information Unit Leader describing UAA findings.

PROCEDURES FOR CONDUCTING USE ATTAINABILITY ASSESSMENTS FOR RECREATION (PRIMARY CONTACT, SECONDARY CONTACT) AND FOOD PROCUREMENT USES (SWUDP-003)

I. INTRODUCTION

A. Kansas Surface Water Quality Standards (K.A.R. 28-16-28b *et seq.*) define beneficial uses for the State's waters and specify water quality criteria necessary to protect those uses. Designated uses and associated water quality criteria serve to define the water quality management goals for a waterbody. Consequently, it is essential that the beneficial uses assigned to a waterbody accurately reflect uses that are attainable. Procedures for conducting use attainability analyses (UAA) are necessary to consistently designate appropriate beneficial uses in waters of the State.

B. The purpose of this Standard Operating Procedure (SOP) is to establish uniform procedures for conducting and reporting the results of UAAs pertaining to the following uses:

1. Recreation

   a. Primary Contact

   b. Secondary Contact

2. Food Procurement

II. APPLICATION

The procedures contained in or referenced by this SOP shall be applicable to all personnel involved in conducting UAAs.

III. GENERAL GUIDELINES

A. EPA regulations in 40 CFR 131.10(a) require that: Each State must specify appropriate water uses to be achieved and protected. The classification of the waters of the State must take into consideration the use and value of the water for public water supplies, protection and propagation of fish, shellfish and wildlife, recreation in and on the water, agricultural, industrial, and other purposes including navigation and

in 40 CFR 131.10(l) that: Where existing water quality standards specify designated uses less than those which are presently being attained, the State shall revise its standards to reflect the uses actually being attained.

B. The procedures used to assess beneficial use attainability and to classify waters for protection in K.A.R. 28-16-28b *et seq*. are shown below for each beneficial use. These procedures include quantitative measures and qualitative guidelines which shall be conducted both in the field and at the desktop level.

C. The water quality standards regulations (40 CFR 131.10(g)) define a UAA as a structured scientific assessment of the factors affecting the attainment of the use, which may include physical, chemical, biological, and economic factors. These regulations state: "States may remove a designated use[11] which is *not* an existing use[12], as defined in Sec. 131.3, or establish subcategories of a use if the State can demonstrate that attaining the designated use is not feasible because:

1. Naturally occurring pollutant concentrations prevent the attainment of the use; or

2. Natural, ephemeral, intermittent or low flow conditions or water levels prevent the attainment of the use, unless these conditions may be compensated for by the discharge of sufficient volume of effluent discharges without violating State water conservation requirements to enable uses to be met; or

3. Human caused conditions or sources of pollution prevent the attainment of the use and cannot be remedied or would cause more environmental damage to correct than to leave in place; or

4. Dams, diversions, or other types of hydrologic modifications preclude the attainment of the use, and it is not feasible to restore the water body to its original condition or to operate such modification in a way that would result in the attainment of the use; or

5. Physical conditions related to the natural features of the water body, such as

---

11 Designated uses are those uses specified in Water Quality Standards for each waterbody or segment whether or not they are actually being attained.

12 Existing uses are those uses actually attained in the waterbody on or after November 28, 1975, whether or not they are designated in the water quality standards.

the lack of a proper substrate, cover, flow, depth, pools, riffles, and the like, unrelated to water quality, preclude attainment of aquatic life protection uses; or

6. Controls more stringent than those required by sections 301(b)[13] and 306[14] of the Act would result in substantial and widespread economic and social impact."

D. EPA regulations regarding use attainability studies further state in 40 CFR 131.10(j): "A State must conduct a use attainability analysis as described in Sec. 131.3(g) whenever:

1. The State designates or has designated uses that do not include the uses specified in section 101(a)(2)[15] of the Act, or

2. The State wishes to remove a designated use that is specified in sections 101(a)(2) of the Act or to adopt subcategories of uses specified in section 101(a)(2) of the Act which require less stringent criteria."

and in 40 CFR 131.10(h) that: "States may not remove designated uses if:

1. They are existing uses, as defined in Sec. 131.3, unless a use requiring more stringent criteria is added; or

2. Such uses will be attained by implementing effluent limits required under sections 301(b) and 306 of the Act and by implementing cost-effective and reasonable best management practices for nonpoint source control."

E. If a use is existing, it must be assigned. If a use is not existing, a determination whether the use is attainable and what sub-use should be assigned is made. A UAA (as defined by EPA) is performed when a 101(a)(2) use (recreation, aquatic life support, or food procurement) is under consideration. If the use is not attainable, a determination must be made that attainment is not feasible because of one of the six 131.10(g) factors. Taken together with use-specific requirements for categorization

---

13 Section 301(b) refers to Effluent Limitations.

14 Section 306 refers to National Standards of Performance.

15 Section 101(a)(2) states: " It is the national goal that wherever attainable, an interim goal of water quality which provides for the protection and propagation of fish, shellfish, and wildlife and provides for recreation in and on the water be achieved by July 1, 1983."

into subclasses, these steps outline Kansas' procedures for assigning beneficial uses.

F. EPA's water quality standards regulations at 40 CFR 131.10 and the Water Quality Standards Handbook (USEPA, 1994) discuss use attainability analysis in the context of being necessary to remove or not designate a use specified by 101(a)(2) of the Clean Water Act. In Kansas the 101(a)(2) uses are aquatic life support, recreation, and food procurement. However, for the purpose of this document, those procedures used for designation of *all* beneficial uses in K.A.R. 28-16-28b *et seq.*, including the 101(a)(2) uses, will collectively be referred to as use attainability analyses.

IV. DEFINITIONS

Designated uses of stream segments shall be those defined in K.S.A. 82a-2001(c), and amendments thereto. Designated uses of surface waters other than stream segments shall be defined as follows:

Recreational use [K.A.R. 28-16-28d (a) (7)] means the use of surface waters other than stream segments for primary or secondary contact recreation.

1. Primary contact recreational use for surface waters other than classified stream segments [K.A.R. 28-16-28d (a) (7) (A)] means use of a surface water other than a classified stream segment for recreation during the period from April 1 through October 31 of each year during which the body is immersed to the extent that some inadvertent ingestion of water is probable. The use shall include boating, mussel harvesting, swimming, skin diving, waterskiing, and windsurfing.

2. Secondary contact recreational use for surface waters other than classified stream segments [K.A.R. 28-16-28d (a) (7) (B)] means recreation during which ingestion of surface water other than classified stream segments is not probable. This use shall include wading, fishing, trapping, and hunting.

Food procurement use [K.A.R. 28-16-28d (a) (4)] means the use of surface waters other than stream segments for obtaining edible forms of aquatic or semiaquatic live for human consumption.

V. WATERBODY SELECTION AND COORDINATION

A. The selection of specific waterbodies for which UAAs will be performed will be determined by the Use Assessment Program, WPMAS, Bureau of Water, Division of Environment, KDHE.

B. The coordination for scheduling and conducting the actual UAAs will be accomplished by the Use Assessment Section staff. A schedule will be prepared and transmitted to BOW WPMAS Assessment and Information Unit Leader at the beginning of each year.

C. An activity leader (Environmental Scientist II) will be assigned to perform the necessary coordination and to conduct or oversee the UAA.

VI. PREPARATION FOR UAA

A. The UAA activity leader shall review all applicable files, databases and maps in order to become thoroughly familiar with the waterbody to be inspected and to determine what sampling will be accomplished.

B. The activity leader should determine if there are any specific issues and/or problems that need to be addressed, any specific information that needs to be obtained, and specific sampling needs to be accomplished during the assessment.

C. Final preparation for the actual inspection should include:

1. Accumulation of appropriate personal safety equipment, assessment tools (credentials, digital camera, assessment forms, global positioning system [GPS] unit), reference material (KDOT maps, topographic maps, aerial photos), sampling equipment (sampling bucket and rope, sample containers, chemical fixatives) and field equipment (pH meter, thermometer, specific conductance meter) to be taken on the actual inspection (Appendix A).

    a. The activity leader should refer to applicable SOP's for determining equipment and supply needs; e.g., sample containers and sample preservation (SOP No. SCMP-005, Appendix B).

    b. A checklist is included as Appendix A to assist the activity leader in this process of determining what equipment is needed and assembling it.

2 Preparation of field sheets and sample tags for documentation and identification of the samples to be collected during the inspection (Appendices C and D).

3 Determination of how samples will be shipped or transported from the field

location to the laboratory for analysis (SOP SCMP-006, Appendix B).

VII. UAA FIELD ASSESSMENT PROCEDURES

A. The number of sites to be assessed on a given waterbody will be determined prior to commencement of field activities. For a lake or wetland, one site may be adequate to characterize existing or potential uses. Stream or river UAAs will generally have more sites (a minimum of three) due to the possibility of anomalous habitat conditions at any given access point.

B. Assessment sites shall be designated for each UAA and clearly marked on Kansas Department of Transportation (KDOT) county maps or 1:24,000 (7.5 minute series) United States Geological Survey (USGS) topographic maps. When possible, GPS coordinates shall be taken on-site and recorded on field forms. GPS readings are required at all assessment sites not clearly indicated as bridge crossings on topographic maps and are strongly recommended for all other sites as well. GPS procedure is documented in SOP No. SCMP-001 (Appendix B).

C. If access to the waterbody is to be made on private property, landowner or resident permission shall be secured prior to access (K.S.A. 21-3721).

D. Narrative UAA site assessments are to be clearly recorded, either by electronic (minicassette recorder) or written means, at each assessment site. Recording observations before moving to the next assessment site is necessary to eliminate risk of mistakes or confusion regarding existing or attainable uses among the multiple sites assessed.

The written assessment shall include waterbody assessed, legal location, GPS coordinates, field physical and chemical data, photographic exposure information, stream width, depth and flow estimations, habitat types present, existing uses actually observed, observations of unusual conditions such as algae blooms, dead fish or unusual odors, streambank water diversions or alluvial wells (located within 50 feet of the waterbody), observations of aquatic life such as fish or mussels, observations of semiaquatic life such as amphibians, waterfowl, or furbearers, and indications of human or livestock access (Appendices D-1 through D-5, as appropriate to the type of waterbody).

E. At a minimum, chemical and physical water quality measurements shall be made at each site assessed for the following parameters: dissolved oxygen, pH, specific conductance, and temperature. Additional parameters will be measured if pertinent

to the support of a particular use.

1. Sample collection, preservation, holding, and shipping/transporting will be accomplished following KDHE SOP SCMP-005 Appendix B).

2. Chain-of-custody will be maintained on all collected samples following current procedures (refer to SOP No. SCMP-006, Appendix B).

F. A photographic record should be made of sites assessed for the UAA. Digital photographs should include an upstream view, downstream view, and any photographs required to document observed or potential uses.

G. Whenever possible, streamside or other local landowners or residents should be interviewed regarding present or past uses of the waterbody. Persons interviewed should be identified by name and legal address in the written assessment.

VIII. USE ASSESSMENT PROCEDURES

A. Recreation - It shall be considered existing if indications of such use are evident and attainable if the waterbody meets the criteria for classification set forth in K.A.R. 28-16-28d(c), which state:

Surface waters shall be classified as follows:

1. Classified stream segments shall be those stream segments that meet the criteria for classification set forth in K.A.R. 28-16-28d(c)(1), which describes classified streams as follows:

A. Streams which have the most recent 10-year median flow of equal to or in excess of 1 cubic foot per second (1.0 cfs) based on data collected and evaluated by the United States geological survey.

B. Streams actually inhabited by threatened or endangered aquatic species listed in rules and regulations promulgated by the Kansas Department of Wildlife, Parks and Tourism or the U.S. Fish and Wildlife Services.

C. Streams which are at the point of discharge and downstream from such point where the Department has issued a National Pollutant Discharge Elimination System permit other than a permit for a confined feeding facility.

D. A stream shall be classified if scientific studies conducted or accepted by the department show during periods of flow less than one cubic foot per second (< 1.0 cfs) stream segments provide important refuges for aquatic life and permit biological recolonization of intermittently flowing segments and a cost/benefit analysis indicates the benefits of classifying the stream outweigh the costs of classifying the stream.

2. Classified lakes shall be all lakes owned by federal, state, county, or municipal authorities and all privately owned lakes that serve as public drinking water supplies or that are open to the general public for primary or secondary contact recreation.

3. Classified wetlands shall be the following:

A. All wetlands owned by federal, state, county, or municipal authorities;

B. All privately owned wetlands open to the general public for hunting, trapping, or other forms of secondary contact recreation; and

C. All wetlands classified as outstanding national resource waters or exceptional state waters, or designated as special aquatic life use waters according to subsection (d).

Wetlands created for the purpose of wastewater treatment shall not be considered classified wetlands.

4. Classified ponds shall be all ponds owned by federal, state, county, or municipal authorities and all privately owned ponds that impound water from a classified stream segment as defined in paragraph (c)(1).

B. Primary contact recreation - The primary contact recreation use applies to surface waters which are used, or have a reasonable potential to be used, for primary contact recreational activities.

1. The primary contact recreation use shall be considered existing in waterbodies in which indications of swimming, kayaking, mussel harvesting, skin diving, waterskiing, or windsurfing uses are evident (based on on-site observation), or which were used for this purpose on or after November 28, 1975 (based on interviews with streamside landowners or other knowledgeable individuals). The use shall be considered attainable if the

waterbody otherwise meets the criteria for designation set forth in this document. The use will also be assigned to all waters along public parks or parkways, urban streams, and other waters with a high probability of public access (e.g., boat ramps, public camping areas, nature trails, playgrounds).

2. Factors which would result in the primary contact recreation use being considered unattainable are related exclusively to volume and depth of water. Waterbodies having an average depth of less than 0.5 meter or maximum depth of less than one meter at base flow conditions (summertime, dry weather) shall be considered incapable of supporting the primary contact recreation use unless indications of said use (e.g., kayaking) are otherwise evident or known to occur at higher flows.

C. Secondary contact recreation - It shall be considered existing in waterbodies in which indications of wading, fishing, trapping, hunting, canoeing, motor boating, rafting, or other types of boating are evident (based on on-site observation), or which were used for this purpose on or after November 28, 1975 (based on interviews with streamside landowners or other knowledgeable individuals). The use shall be considered attainable if the waterbody meets the criteria for classification set forth in K.A.R. 28-16-28d(c).

D. Food procurement - For waterbodies designated for aquatic life support use, the food procurement use shall be considered existing in waterbodies in which there is visual or recorded (i.e., KDWPT creel censuses or fishery surveys) evidence of fishing, consumption of crawfish, mussels or aquatic macrophytes, or waterfowl hunting activities (based on on-site observation), or which were used for this purpose on or after November 28, 1975 (based on interviews with streamside landowners or other knowledgeable individuals). The use shall be considered attainable if the waterbody meets the criteria for classification set forth in K.A.R. 28-16-28d(c).

IX. UAA DOCUMENTATION

A. Finalized Use Attainability Assessments will be maintained on file by the Use Assessment Program.. UAA findings will be communicated by memorandum to WPMAS for inclusion in proposed revisions to the KSWQS surface water registry.

B. The finalized UAA file, reviewed and approved by the Environmental Scientist IV and maintained by the Environmental Scientist II, Use Assessment Program, will contain, at a minimum, the following materials:

1. completed UAA field sheets (Appendix D) including field notes and labeled digital photographs,

2. photocopied KDOT county maps or USGS 1:24,000 (7.5 minute series) topographic maps of the waterbody segment assessed,

3. waterbody physicochemical data - both data obtained during the field assessment and (where available) from USEPA STORET database,

4. printouts of information obtained from WIMAS, KDHE-PWS, or other databases or sources of information pertaining to the referenced designated uses.

5. copy of the memorandum to WPMAS describing the UAA findings.

Form B-1

FIELD ASSESSMENT WORKSHEET
USE ATTAINABILITY ANALYSIS (UAA)
FOR
PRIMARY & SECONDARY CONTACT RECREATION

Waterbody Name: _____ HUC:_____

Basin: _____ Segment:_____ Station:_____

Location (Legal): ___ 1/4 ____ 1/4 Sec. ____ T ____ S R ____ E Quadrangle:_____

Evaluators: _____ Date:_____

Site Location Map or attach photographs:

The evaluator is encouraged to add comments and observations which will aid in making decisions about the site.

Direct evidence of:
Primary contact recreation activities? _____ Yes ____ No
Secondary contact recreation activities? _____ Yes ____ No

If people are observed recreating in the water, or if direct evidence exists of primary and/or secondary contact recreation, then primary and/or secondary contact recreation are considered existing uses. Types of direct evidence might include rope swings, campfire rings, boat ramps or other constructed or evident points of access.

COMMENTS:

_____
_____
_____
_____

Sufficient water to support primary contact recreation? _____ Yes _____ No

An average depth of at least 0.5 meter or a maximum depth of at least 1.0 meter at base flow conditions is considered minimal for primary contact recreation. Base flow, as defined in

K.A.R. 28-16-28b(f), means that portion of a stream's flow contributed by sources of water other than precipitation runoff. This refers to a fair weather flow sustained primarily by springs or groundwater seepage, wastewater discharges, irrigation return flows, releases from reservoirs, or some combination of these factors.

COMMENTS:

_____
_____
_____
_____

Economic Considerations:

What activities are apparent along the stream that might impact the water quality of the stream segment, i.e. discharges, cropland, grazing activities, etc.?

COMMENTS_____

Form B-2

FIELD ASSESSMENT WORKSHEET
USE ATTAINABILITY ANALYSIS (UAA)
FOR
FOOD PROCUREMENT

Waterbody Name:_____ HUC: _____
Basin: _____ Segment:_____ Station _____

Location (Legal): ____ 1/4 ____ 1/4 Sec. ____ T ____ S R ____ E Quadrangle:_____

Evaluators:_____ Date:_____

Site Location Map or attach photographs:

The evaluator is encouraged to add comments and observations which will aid in making decisions about the site.

Direct evidence of:
Food procurement activities? _____ Yes _____ No

For food procurement designation, note any evidence of fishing activities such as fishing lines, bait cans, etc. Indicate findings regarding food procurement in comment section.

COMMENTS:

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

VEHICLE SAFETY AND MAINTENANCE PROCEDURES (SCMP-002)

I. INTRODUCTION

A. Purpose

The following paragraphs describe the standard vehicle safety and maintenance procedures used during assessment/monitoring activities. Safety procedures are established to prevent or minimize property damage, personal injuries, and/or loss of life. Maintenance procedures are established to prevent or minimize vehicle breakdowns and to extend the usable life of the vehicle. Accidents and mechanical failures are costly and result in loss of productivity.

B. Equipment/Accessories

1995 Ford Club Wagon, 2001 Chevrolet Silverado

II. PROCEDURES

A. Vehicle Safety Procedures

1. The following safety precautions are followed while operating motor vehicles during assessment/monitoring activities:

   a. The vehicle operator must possess a valid Kansas driver's license.

   b. SEAT BELTS SHALL BE WORN AT ALL TIMES INCLUDING DRIVER AND PASSENGERS WHILE OPERATING MOTOR VEHICLES.

   c. Vehicles shall not be driven at speeds greater than the posted speed limit or prevailing road conditions.

   d. Proper driving intervals will be maintained behind the vehicle ahead.
   e. Drivers shall not pass in posted zones or when the safety of passing is in doubt.

   f. or electrical turn signals will be used when operating vehicles.

g. The vehicle shall be operated in accordance with the manufacturer's manual.

2. Vehicles will be safety checked for problems before and after each assessment/monitoring trip. Vehicles with potentially serious operational defects shall not be used for assessment/monitoring events.

3. Vehicles shall not be operated when the driver has been continuously on-the-job in excess of ten hours, or when the driver is ill or under medications that prohibit vehicle operation.

4. When transporting cargo, samples shall not be stacked higher than the back seat or safety screening.

5. Safety equipment, fire extinguishers, first aid kits shall be maintained in assessment/monitoring vehicles at all times.

6. Vehicles shall not be parked in any location that may cause traffic hazards or impede traffic flows.

B. Vehicle Maintenance Procedures

1. The vehicle shall be scheduled for normal service maintenance every 5,000 miles. The maintenance work performed typically includes: oil and filter changed, chassis and suspension lubricated, fluids checked, antifreeze strength analyzed, and tires rotated. Additionally, the following components are inspected: belts, hoses, tires, shocks and/or struts, brakes, air conditioner, heater, lights, windshield wipers, and exhaust system. Other repairs are performed as needed.
2. Other routine maintenance, such as tune-ups, air and fuel filter replacement, wheel bearing inspection and grease repacking, "wheels off" brakes inspection, etc. shall be performed according to the vehicle manufacturer's recommendations. This information may be obtained from the vehicle owner's manual..

3. All emergency repairs, unscheduled maintenance, or towing shall be performed by an authorized auto maintenance facility. Minor "on the road" repairs costing less than $200.00 (parts and labor) may be done by any qualified and authorized facility. If the repair estimates are greater than $200.00, the BEFS must be contacted for approval prior to having any work

done.

4. The purchase of tires and batteries is covered under State contract. A list of authorized vendors and acceptable types of tires or batteries is available from BEFS office staff. Copies of these contracts may be found on the vehicle log clipboard.

5. An adequate supply of fuel shall be maintained in the gas tank at all times. A "Wright Express" Credit Card is used whenever purchasing gasoline. To use the credit card, the employee enters his/her employee ID number and vehicle odometer reading to purchase gas. During the refueling process, clean the windshield if necessary, check the engine oil level, and visually inspect the tires.

6. The vehicle log shall be updated each time the vehicle is utilized by entering the appropriate date, operator's name, mileage, and destination. All vehicle purchases and/or repair costs shall also be reported in the vehicle log. The vehicle logs and accompanying receipts shall be turned over to the KDHE Business Office on a monthly basis.

MAINTENANCE AND CALIBRATION PROCEDURES FOR FIELD ANALYTICAL EQUIPMENT (SCMP-003)

I. INTRODUCTION

A. Purpose

The following paragraphs establish uniform procedures for the proper care, calibration, and maintenance of pH meters, conductivity meters, and thermometers.

B. pH Meter Specifications

Manufacturer:	Cole-Parmer
Instrument type:	Portable Analog pH Meter
Model number:	5996-70
Range:	0 to 14 pH Units
Relative accuracy:	0.01 pH Units
Resolution:	0.01 pH Units

C. Conductivity Meter Specifications

Manufacturer:	Hach
Instrument type:	Portable Conductivity Meter
Model number:	2510
Accuracy:	plus or minus 2% of full scale
Range selection:	(1) 0-2 microhms/cm
	1. 0-20 microhms /cm
	2. 0-200 microhms /cm
	3. 0-2,000 microhms /cm
	4. 0-20,000 microhms /cm

D. Thermometer Specifications

Manufacturer:	Fisher
Instrument type:	Dial scale thermometer
Model number:	15-0778
Range:	-10 to 110 degrees Celsius

II. PROCEDURES

A. pH Meter

The portable pH instrument is battery operated and uses an analog display. The electrode is a gel-filled plastic combination electrode with BNC connector. A porous plug in the tip of the probe serves as a junction permitting the gelled electrolyte to make electrical contact with the sample being measured.

1. pH Meter Calibration

   a. Connect electrode to instrument and remove electrode cap.

   2. Set the temperature knob to correspond with the buffer temperatures.

   c. Immerse electrode in pH 7 buffer solution. Stir vigorously and adjust "set" knob on instrument until the meter reading stabilizes and continuously reads 7.00.

   d. Rinse the electrode thoroughly in distilled water, and shake off excess water.

   e. Immerse electrode in pH 10 buffer solution. Stir vigorously and adjust the "slope adjustment" knob on the instrument until the meter stabilizes and continuously reads 10.00.

   f. Rinse the electrode in distilled water, and shake off excess water.

2. pH Meter Maintenance

   a. The pH meter must be thoroughly inspected at least every six months to ensure proper operation. Proper calibration of the instrument must be confirmed prior to each field trip. If the meter is malfunctioning, a

backup meter shall be used pending repair or replacement.

b. Routine maintenance shall include periodic electrode and battery replacement. At a minimum, batteries and electrodes must be replaced annually. All maintenance checks and electrode/battery replacements shall be recorded in the instrument log book.

c. If the electrode becomes dirty or if a crust develops, rinse thoroughly with Distilled water or stir the electrode in water and detergent solution. DO NOT ABRADE ELECTRODE BY WIPING OR CLEANING WITH CLOTHS OR PAPER TOWELS. Carefully clean the electrode tip to insure it is free from contaminants. For protein layers, wash with pepsin or 0.1N HCL; for inorganic deposits, wash with EDTA or acids; and for grease or similar films, wash with acetone, methanol or di-ethyl ether.

d. Record all operational problems, routine maintenance actions, and instrument repairs in the instrument log book.

e. Proper operation of the pH meter shall be evaluated by the section chief during annual system and performance audits.

B. Conductivity Meter

The portable conductivity meter is a battery operated instrument used to directly measure specific conductance in umhos/cm. The probe consists of tungsten electrodes and two thermistors enclosed in a stainless steel tube which is housed in thermoplastic. The probe should be stored dry. The thermistors automatically compensate for temperature variations. The instrument operates in five ranges selectable with a front panel switch.

1. Conductivity Meter Calibration

a. Check the batteries by switching to range 5 and set mode switch to the two (+ and -) "Batt Chk" positions while observing the meter deflections. A battery check arrow on the meter scale indicates minimum performance for good batteries. A reading below the arrow requires replacement of batteries.

b. Adjust zero by turning the instrument off and mechanically zero the

meter using the screw-driver adjustment control on the meter face.

c. Bias adjustment can be checked after adjusting for zero (see step 2). Disconnect the probe and turn the instrument on. Set to range 1 and observe the meter. If the reading is not zero, then open case and adjust bias control.

To standardize the instrument, place the probe in a 0.01M KCl solution. Turn instrument on and set to range 4. The meter should read 1413 umhos/cm at 25 degrees Celsius. If the error is greater than 10%, then open case and adjust standardization potentiometer on the circuit board.

2. Procedures for Conductivity Meter Maintenance

a. The conductivity meter must be thoroughly inspected prior to every field season to ensure proper operation. The instrument must be properly calibrated prior to each field trip. If the meter is malfunctioning, a backup meter must be used pending repair or replacement of the instrument.

b. Routine maintenance may include probe or battery replacement. All maintenance checks are recorded in instrument log book. Replace batteries annually or as needed. Typical battery life is approximately one year.

c. If the probe becomes dirty or crust develops, rinse thoroughly with Distilled water or stir the probe in water and detergent solution. To clean the probe of oils, greases, or fats use a strong detergent solution or dip the probe in a one-to-one mixture of hydrochloric acid and distilled water, then rinse with distilled water.

d. Record all operational problems, routine maintenance actions, and instrument repairs in the instrument log book.

e. Proper operation of the conductivity meter shall be evaluated by the section chief during annual system and performance audits.

C. Thermometer

The Fisher model #15-0778 stainless steel dial scale thermometer is an easy to use, portable, manual, direct read instrument. It measures temperature in Celsius ranging from -10 to 110 degrees.

1. Thermometer calibration is checked against a reference thermometer traceable to the National Institute of Standards and Technology (NIST). If adjustment is required, carefully turn the adjusting nut located on the back of the dial until the correction is completed.

2. Procedures for thermometer maintenance include a thorough inspection prior to every field season to ensure the instrument is properly calibrated and operating within manufacturer's specifications. If the instrument is malfunctioning and/or cannot be calibrated, then it must be replaced. If the probe becomes dirty or if a crust develops, rinse it thoroughly with distilled water or a mild detergent solution.

MAINTENANCE AND CALIBRATION PROCEDURES FOR FIELD ANALYTICAL EQUIPMENT (LWMP-001)

I. INTRODUCTION

A. Purpose

The following paragraphs describe the procedures used to ensure the proper and reliable operation of field measurement apparatus used in the lake and wetland water quality monitoring program.

B. Thermometer Specifications

Manufacturer:	Fisher
Instrument type:	Dial scale thermometer
Model number:	15-0778
Range:	-10 to 110 degrees Celsius
Resolution:	1.0 degree Celsius

C. pH Meter Specifications

Manufacturer:	Cole Parmer
Instrument type:	Portable digital pH meter
Model number:	5996-80
Range:	0-14 pH units
Resolution:	0.01 pH units

D. Dissolved Oxygen Meter Specifications

Manufacturer:	YSI
Instrument type:	Portable temperature/DO meter
Model number:	51b
Range:	-5 to 45 ^{o}C, 0-15 mg DO/L
Resolution:	0.5 ^{o}C, 0.1 mg DO/L

1.5 Light Meter Specifications

Manufacturer:	Li-Cor

Instrument type:	Portable light/quantum meter
Model number:	LI-250 digital meter LI-193SA underwater spherical quantum sensor
Range:	1 to >10,000 umol/s/m^2
Resolution:	1 umol/s/m^2

II. PROCEDURES

A. Fisher Dial Scale Thermometer

1. Procedures described in SOP No. GQMP-003.II.C are adopted by reference.

B. Cole Parmer pH Meter

2. Procedures described in SOP No. GQMP-003.II.A are adopted by reference.

C. YSI Dissolved Oxygen Meter

1. At the beginning of each sampling season, the DO meter has the probe membrane and batteries checked and/or replaced. Afterwards, the meter is checked against Winkler wet-chemistry for accuracy. The dissolved oxygen readings should be within 0.5 mg/L of the Winkler readings.

2. At the time of each use, the meter is checked for battery level (zero and full-scale settings).

3. The meter is air-calibrated, using a probe chamber with a near 100% saturated atmosphere according to manufacturers instructions. The calibration is against the elevation of the sampling location, taken from state highway maps or USGS topographic maps.

4. After calibration, the probe is freed from the calibration/storage chamber and placed in the water to be measured.

5. A Winkler sample is collected from the water surface for later

comparison to the meter reading. This procedure helps identify the need for any meter maintenance during the sampling season. If problems are encountered, procedure II-C-1 is repeated. If necessary, the meter and/or probe are sent to the manufacturer for repair.

6. After use, the probe is placed back in its calibration storage chamber and the meter is turned off. For short storage periods (to the next lake) the chamber may be filled with lake water, that is not high in suspended solids, or distilled water. For long-term storage, the chamber should be rinsed and filled with distilled water. The chamber should be filled with about 1.0 inch of water, enough to maintain near 100% humidity within the chamber.

D. Li-Cor Light/Quantum Meter

At the beginning of each sampling season, the batteries are replaced and the calibration constants (loaded in the meter•s memory) are checked.

At the time of use the meter is first checked against the air calibration value and a reading is taken above the air/water interface.

The meter is then lowered to just below the air/water interface, and checked using the underwater calibration value. If either calibration value is off, the screw adjustment, located on the back, is used to re-calibrate the meter.

Readings are then taken every meter until the 1% penetration depth for photosynthetically active wavelengths is reached.

The meter and probe are allowed to dry before sealing the storage box, and the meter is detached and stored in its own sealed box to prevent moisture interfering with the meter.

CALIBRATION AND MAINTENANCE PROCEDURES FOR FIELD ANALYTICAL EQUIPMENT (GQMP-003)

I. INTRODUCTION

A. Purpose

The following paragraphs establish uniform procedures for the proper care, calibration, and maintenance of pH meters, conductivity meters, and thermometers. For any equipment information not covered in this document, refer to the appropriate manufacturer's instruction manual.

B. pH Meter Specifications

Manufacturer:	Cole-Parmer Instrument Company
Instrument type:	Portable Analog pH Meter
Model number:	5996-70
Range:	0 to 14 pH Units
Relative accuracy:	0.05 pH Units

C. Conductivity Meter Specifications

Manufacturer:	Fisher Scientific Company
Instrument type:	Portable Digital Conductivity Meter
Model number:	09-327-1
Accuracy:	0.4% maximum limit of error
Range selection:	1) 0-200 microhms /cm
	2) 0-2,000 microhms /cm
	3) 0-20,000 microhms /cm
	4) 0-200,000 microhms /cm

D. Thermometer Specifications

Manufacturer:	Fisher Scientific Company
Instrument type:	Dial scale thermometer
Model number:	15-0778
Range:	-10 to 110 degrees Celsius

II. PROCEDURES

A. pH Meter

The portable pH instrument is battery operated and feature two point standardization and manual temperature compensation. The electrode is a gel-filled plastic combination electrode with BNC connector. A porous plug in the tip of the probe serves as a junction permitting the gelled electrolyte to make electrical contact with the sample being measured.

1. pH Meter Calibration

a. Connect pH electrode to instrument and remove electrode cap.

Turn pH meter on by setting instrument switch to pH mode.

c. Set **TEMP EC** control to the sample temperature.

d. Immerse electrode in pH 7 buffer solution. Stir vigorously, then adjust **SET** control for a reading of 7.0.

e. Rinse electrode with distilled water and place in either pH 4 or 10 buffer solution, whichever is closer to the measurement being taken.

Allow a few seconds for the reading to stabilize, then adjust **SLOPE** control for a pH reading of 4.0 or 10.0 (depending on buffer used).

g. Rinse the electrode with distilled water and blot or shake off excess water.

The pH meter is now calibrated and ready to use.

NOTE: Calibration of a pH meter is **not** permanent. It should be done on a regular basis.

2. pH Meter Maintenance

a. The pH meter must be thoroughly inspected at least every six months to ensure proper operation. Proper calibration of the instrument must be confirmed prior to each field trip. If the meter is malfunctioning, a

backup meter shall be used pending repair or replacement.

b. Routine maintenance shall include periodic electrode and battery replacement. At a minimum, batteries and electrodes must be replaced annually. All maintenance checks and electrode/battery replacements shall be recorded in the instrument log book.

If the electrode becomes dirty or if a crust develops, rinse thoroughly with distilled water or stir the electrode in water and detergent solution. DO NOT abrade electrode by wiping or cleaning with cloths or paper towels. To remove excess water, just blot the end of the electrode with a lint free paper. Wiping an electrode can also cause spurious readings due to static charges. Carefully clean the electrode tip to insure it is free from contaminants. For protein layers, wash with pepsin or 0.1N HCL; for inorganic deposits, wash with EDTA; and for grease or similar films, wash with acetone, methanol or di-ethyl ether.

d. Record all operational problems, routine maintenance actions, and instrument repairs in the instrument log book.

e. Proper operation of the pH meter shall be evaluated by the section chief during annual system and performance audits.

B. Conductivity Meter

The portable conductivity meter is a battery operated instrument used to directly measure specific conductance in Φmhos/cm. The probe contains an internal thermistor and should be stored dry. The thermistor automatically compensates for temperature variations. The instrument operates in four ranges selectable with a front panel switch.

1. Conductivity Meter Calibration

a. Check and/or replace the battery if the meter displays erratic readings, no LCD display at all, or if **LO BAT** is displayed.

b. Place the probe in a 0.01M KCl solution or other acceptable known calibration solution. Ideally, the calibration solution temperature should be close to 25.0E C.

Turn instrument on and set the range switch to give the largest reading possible. Avoid calibrating

on one range and making measurements on another range.

The meter should read 1413 Φmhos/cm at 25.0E C if you are using a 0.01M KCl solution. Insert a small blade screwdriver and adjust the red standardization screw until the proper value is obtained.

Thoroughly rinse the probe with distilled water after completing the calibration process.

2. Procedures for Conductivity Meter Maintenance

a. The conductivity meter must be thoroughly inspected prior to every field season to ensure proper operation. The instrument must be properly calibrated prior to each field trip. If the meter is malfunctioning, a backup meter must be used pending repair or replacement of the instrument.

b. Routine maintenance may include probe or battery replacement. All maintenance checks are recorded in instrument log book. Replace batteries annually or as needed. Typical battery life is approximately one year. The manufacturer recommends using alkaline batteries.

c. If the probe becomes dirty or crust develops, rinse thoroughly with distilled water or stir the probe in water and detergent solution. To clean the probe of oils, greases, or fats use a strong detergent solution or dip the probe in a one-to-one mixture of hydrochloric acid and distilled water, then rinse with distilled water.

d. Record all operational problems, routine maintenance actions, and instrument repairs in the instrument log book.

e. Proper operation of the conductivity meter shall be evaluated by the section chief during annual system and performance audits.

C. Thermometer

The Fisher model #15-0778 stainless steel dial scale thermometer is an easy to use, portable, manual, direct read instrument. It measures temperature in Celsius ranging from -10 to 110 degrees.

1. Thermometer calibration is checked against a reference thermometer traceable to the National Institute of Standards and Technology (NIST). If

adjustment is required, carefully turn the adjusting nut located on the back of the dial until the correction is completed.

3. Procedures for thermometer maintenance include a thorough inspection prior to every field season to ensure the instrument is properly calibrated and operating within manufacturer's specifications. If the instrument is malfunctioning and/or cannot be calibrated, then it must be replaced. If the probe becomes dirty or if a crust develops, rinse it thoroughly with distilled H_20 or a mild detergent solution.

PROCEDURES FOR FIELD ANALYTICAL MEASUREMENTS (SCMP-004)

I. INTRODUCTION

A. Purpose

The following paragraphs describe the procedures routinely employed by program staff for the measurement of stream water temperature, pH, and electrical conductivity.

B. Equipment/Accessories

1. Fisher model #15-0778 stainless steel dial scale thermometer (-10 to +110 °C)

2. Cole-Parmer model #5996-70 analog pH meter (with instruction manual, carrying case, combination pH probe, and pH 4, 7, and 10 buffer solutions)

3. Hach model #2510 portable conductivity meter (battery operated with instruction sheet and plug in probe)

II. PROCEDURES

A. Thermometer

Immerse at least a couple of inches of the slender probe into the sample. Avoid touching the probe just prior to and during the measurement. Read the temperature to the nearest one degree by observing the indicator on the dial. Do not use the thermometer to measure substances colder than -10 or hotter than 110 degrees Celsius.

B. pH Meter

a. Immerse electrode in sample. Set "temperature" knob to the sample temperature. Allow time for the electrode to reach sample temperature.

b. After the LED digital readout stabilizes, read the display for the sample pH and record on field data sheet.

c. Rinse the electrode in distilled water between samples.

C. Conductivity Meter

a. Plug probe to connector on back of meter housing.

b. Immerse electrode in sample until vent holes are submerged. Dip probe in and out a few times and gently stir.

c. Begin with "range" knob on range 5. Set "mode" knob to the "on" position. If the reading is in the lower 10% of the range, switch to the next lower range (range 4 is used the most).

d. After the needle on the meter stabilizes, read the meter face for the sample specific conductance and record the data on the field sheet. Report values to the nearest 0.05 umhos/cm while in range 1, to the nearest 0.5 umhos/cm while in range 2, to the nearest 5 umhos/cm while in range 3, to the nearest 50 umhos/cm while in range 4, and to the nearest 500 umhos/cm while in range 5.

e. Thoroughly rinse the probe in distilled water between samples.

f. Turn meter off after use. Unplug probe and store it dry.

PROCEDURES FOR FIELD ANALYTICAL MEASUREMENTS (GQMP-004)

I. INTRODUCTION

A. Purpose

The following paragraphs describe the procedures routinely employed by program staff for the measurement of water temperature, pH, and electrical conductivity.

B. Equipment/Accessories

1. Fisher model #15-0778 stainless steel dial scale thermometer (-10 to +110 °C)

2. Cole-Parmer model #5996-80 portable analog pH meter (battery operated with instruction sheet, carrying case, combination pH probe, and pH 4, 7, and

10 buffer solutions)

3. Fisher model #09-327-1 portable digital conductivity meter (battery operated with instruction sheet and probe).

II. PROCEDURES

A. Thermometer

Immerse at least a couple of inches of the slender probe into the sample. Avoid touching the probe just prior to and during the measurement. Read the temperature to the nearest one degree by observing the indicator on the dial and record the temperature on the field data sheet. Do not use the thermometer to measure substances colder than -10 or hotter than 110 degrees Celsius.

B. pH Meter

a. Connect pH electrode to instrument and remove electrode cap. Immerse the pH electrode in the unknown sample. Turn pH meter on by setting instrument switch to pH mode. Set **TEMP EC** control to the sample temperature. Allow time for the electrode to reach sample temperature.

b. After the meter readout stabilizes, read the display for the sample pH and record to the nearest 0.1 standard pH unit on the field data sheet.

c. Rinse the electrode in distilled H_20 between sample measurements.

C. Conductivity Meter

a. Plug probe to connector on back of meter housing.

Immerse the conductivity probe in the unknown sample. Dip the probe up and down a few times and gently stir to remove air bubbles from the tip.

Turn the function knob to MICROMHO. Using the range knob, select the range which gives the largest reading possible. The 2,000 range is the most commonly used setting when measuring Kansas ambient groundwater samples.

d. After the reading on the meter=s display window stabilizes, record the specific conductance measurement on the field sheet. As a rule of thumb, values may be averaged and reported to the nearest 1 Φmhos/cm while in range 200, to

the nearest 10 Φmhos/cm while in range 2,000, to the nearest 100 Φmhos/cm while in range 20,000, and to the nearest 1,000 Φmhos/cm while in range 200,000.

e. Thoroughly rinse the probe in distilled H_20 between samples.

f. Turn meter off after use. Unplug probe and store it dry.

PROCEDURES FOR COLLECTING, PRESERVING AND TRANSPORTING STREAM WATER SAMPLES (SCMP-005)

I. INTRODUCTION

A. Purpose

The following paragraphs describe the proper procedures for the collection, preservation, and transportation of stream water samples.

B. Field Sampling Equipment/Accessories

1. Stainless steel self-filling bucket (1 gal)
2. Stainless steel pail (1 gal)
3. Cole-Parmer pH meter kit
4. Winkler dissolved oxygen kit
5. Fisher model #15-0778 stainless steel dial scale thermometer
6. Rope, cotton fiber, 75-ft length with snap swivel
7. Coleman ice chest (100 qt)
8. Fluorescent orange safety vest
9. Rubber rain coats
10. Hand sanitizer solution
11. Camera (35 mm or digital)
12. Clipboard
13. County maps
14. Kansas highway map
15. Sample container (wooden crates)
16. Glass beakers (100 ml)
17. Plastic dispensing squeeze bottle for distilled water (500 ml)
18. Rubber boots
19. Permanent black markers and ink pens
20. Plastic storage tubs

II. PROCEDURES

A. General Collection and Preservation

Several of the samples must be chemically preserved before storage and transport to the laboratories. The collection and preservation procedures are as follows:

1. All surface water samples are to be collected from the stainless steel self-filling bucket or the stainless steel pail.

2. The sample is collected from the bridge at the monitoring site using a rope and stainless steel sampling container. The samples are collected from the main flow or main braid of the stream. When the stream is too shallow for using the stainless steel self-filling bucket, the stainless steel pail is used for sample collection.

3. Prior to sampling all sample containers should be labeled and their corresponding numbers recorded on the field collection sheet for the respective monitoring site.

4. When preparing the stainless steel self-filling bucket for sampling, three sample bottles (dissolved oxygen, bacteriological, nutrient) are loaded in to the sampling bucket. The self-filling bucket has four fill pipes that fill the bucket when submerged in the water column. One of the fill pipes is placed into each of the sample bottles in order that the bottles are filled from the bottom up without undue aeration. The dissolved oxygen (DO) sample must not be aerated during collection and preservation. Place the lid on the sample bucket and secure with lid nut. Fix the sampling rope to the sampling bucket by attaching the snap swivel to the lid nut. Lower the sampling bucket in the stream and fill.

5. After the sample bucket is filled, it is retrieved and returned to the sampling vehicle for sample preparation and preservation.

6. Remove lid and remove sample bottles from the sampling bucket. Place the thermometer in the sampling bucket and record temperature.

7. The inorganic samples and biochemical oxygen demand (BOD) samples are collected in a one quart cubitainer. The inorganic and heavy metal sample containers are filled directly from the sampling bucket.

8. The nutrient, DO and bacteriological samples after being removed from the sampling bucket are preserved and stored. The nutrient sample is preserved with 2 ml of nitric acid, the bacteriological sample volume is adjusted to the fill line on the bottle, then capped stored immediately in the sampling cooler. The DO sample is fixed according to the Winkler method (Standard Methods) and is stored for transport to the inorganic chemistry laboratory.

9. All samples that are stored in the sample cooler are iced down and not removed from the sampling cooler until submitted to the appropriate laboratory.

B. Specific Sample Collection and Preservation

1. Dissolved Oxygen

a. Add 2 milliliters of manganous sulfate to the sample from the Winkler (DO kit). The reagent is referred to the #1 reagent marked on the reagent bottle. To dispense the reagents, squeeze the reagent bottle gently forcing the reagent into the 2 ml dispensing pipet. Then empty the 2 ml reagent into the DO sample bottle by placing the pipet just above the surface of the water in the DO bottle.

b. Add 2 milliliters of alkaline-iodide-azide. This reagent is referred to a #2 reagent marked on the reagent bottle.

c. After reagents #1 and #2 have been added to the DO bottle, close the stopper on the DO bottle and then the DO sample bottle is inverted and shaken 25 times for mixing of reagents with sample water. The sample is than set aside to let the forming floc to settle. Time should be allowed to let the floc settle about 1/3 of the way down the bottle. The rate of floc settling is influenced by the water temperature. The warmer the sample water, the quicker the settling and conversely the colder the sample water the slower the settling rate.

d. After the floc has settled 1/3 of the way down the bottle, add 2 milliliters of sulfuric acid. This reagent is referred to as #3 and marked on the reagent bottle.

e. Re-stopper the bottle and shake for 25 times. Shaking breaks up the floc and insures the sample is well mixed with reagent. The sample

will then have two primary colors or intermediate phases, a dark brown color generally indicates a high amount of DO concentration in the sample and a light or clear color indicates little or no DO is the sample.

f. The sample is then placed in a storage container for transport to the inorganic chemistry laboratory. Samples should not be stored in direct sun light.

2. Nutrient Sample

a. Remove the nutrient sample for the sample bucket and discard a small amount of the sample water from the sample container to make room for the added fixative.

b. Add 1 milliliters of 1:30 sulfuric acid fixative to the sample bottle. Cap the sample bottle and shake for 10 seconds.

c. Store the nutrient sample in storage container for transport to the inorganic chemistry laboratory.

3. Bacteriological Sample

a. The bacteriological sample bottle is removed from the sample bucket using caution not to touch inside the neck of the bottle or inside of the bottle cap. Careless handing handling of the bottle may contaminate the sample with bacteria from the collector's hand.

b. The sample bottle should not be filled above the black fill line drawn on the bottle. This allows for complete mixing and resuspension of the bacteria at the time of analysis preparation.

c. The bacteriological sample is placed in sample cooler for transport to the environmental microbiology laboratory.

4. Heavy Metal Sample

a. The heavy metal sample bottle is filled from the sample bucket into the plastic bottle marked H.M. Leave approximately 1 . inches from the top of the bottle for mixing space. Caution must be used not to

over-fill or flush the preservative from the bottle because the sample bottle has been prefixed with nitric acid solution.

b. The sample is shaken for 10 seconds for mixing purposes. The sample is placed in the sample container for transport to the laboratory.

5. Pesticide (Organic) Sample

a. The pesticide container is a one gallon amber glass jug that has been acetone washed by the laboratory. The jug is filled from the stainless steel bucket or stainless steel pail using the stainless steel funnel. Plastic containers or funnels should not be used for collecting organic samples because of the possibility of contamination of the sample from the plastic.

b. Store the sample container in sample cooler for transport to the organic chemistry laboratory.

6. Radiation Sample

a. The radiation chemistry sample is collected in a one gallon plastic jug provided by the laboratory. The radiation chemistry sample container is filled from the stainless bucket or pail.

b. Store the sample in the vehicle for transport to the radiation chemistry laboratory.

7. Volatile Organic Sample

a. Label the vial prior to collection with the appropriate information: public water supply name, collector's initials, date of collection and identification number.

b. The volatile organic sample vial is filled from the stainless steel bucket. The vial should be filled carefully until there is a convex meniscus above the lip of the vial.

c. Float the Teflon-lined septum (cap liner) on top of the meniscus (water above the vial lip) insuring that the Teflon side (thin white

side) is in contact with the water.

d. Screw the vial cap on to the vial carefully and tightly. Turn vial upside down, tap lightly, and observe for air bubbles. If air bubbles are present, empty the vial, flush and fill with new sample and repeat steps 2 - 4.

e. Store the vial in the sample cooler for transport to the organic chemistry laboratory.

8. Temperature and pH Measurements

a. Place the dial scale stainless steel Celsius thermometer in the stainless steel bucket and note the temperature reading.

b. Record the temperature reading to the nearest degree on the field sheet.

c. pH measurements should be conducted in accordance with the operation SOP for the pH meter and the pH reading recorded on the field sheet.

9. Replicate Samples

Replicate sampling are utilized for quality control to assure that the field collection procedures provide representative and valid results. These samples are collected at the same, utilizing the same sample collection, preservation and storage procedures, the same sample collection equipment and sample containers. The frequency of replicate samples is 10% or one replicate per sampling run.

C. Sample Collection, Preservation and Transport Safety

When sampling the sample collector must observe the sampling safety protocols at all times:

1. VEHICLES SHALL NOT BE PARKED ON BRIDGES IN SUCH A MANNER TO CAUSE TRAFFIC HAZARDS OR IMPEDE TRAFFIC FLOWS.

2. Fluorescent orange safety vests shall be worn by all sampling personnel while

sampling.

3. Sample collectors must use caution when leaning over bridge railings when pulling or retrieving sample buckets or equipment.

4. Sample collectors must exercise caution when sampling from slippery or icy bridge surfaces.

5. If water conditions (high flows, flooding), weather conditions (dangerous storms) or other physical factors are such that the samples cannot be collected according to QA/QC and safety protocols, the sampler shall not attempt to collect samples by unauthorized or unsafe methods. Examples of conditions that may prevent routine sampling would be rivers or streams frozen to the extent that the ice breaker cannot be used to break the ice or if the bridge is closed or unsafe structurally. If wading is necessary during extreme low flows, waders should use a wading stick or pole to check the depth where the stream substrate is not visible. In all sampling activities, no sampling should be attempted that would involve driving or walking on ice.

6. Sample collector shall wear prescribed eyeglasses or safety glasses when preserving samples with acids or reagents. Protective disposable gloves should be worn for protection when preserving water samples that may contain hazardous materials or sewage effluents. Reagents or preservatives shall not be used while the vehicle is in motion.

4. Sample containers, sample reagents and acids shall be stored and secured during transport. Sample containers and coolers should not be stacked in an unsecured manner. All reagents bottles shall be capped when not in use or while in transport.

LABORATORY ANALYTICAL PROCEDURES FOR LAKE AND WETLAND WATER QUALITY SAMPLES (LWMP-005)

I. INTRODUCTION

A. Purpose

The following paragraphs describe the procedures for the analysis of Winkler DO samples and chlorophyll-a samples collected by staff of the Kansas lake and wetland water quality monitoring program.

B. Equipment/Accessories

1. Milton-Roy "Spectronic 501" UV/visible spectrophotometer

2. Wild Heerbrugg, model M40, inverted microscope and modified Sedgwick-Rafter counting cell, settling tubes

3. Chicago Surgical and Electrical Company safety angle centrifuge (3,400 rpm)

4. Titration buret, titrant, starch solution

5. Tissue grinder, centrifuge tubes, forceps, vacuum filter manifold, 0.45 micron glass fiber filters

Fluorescent light banks

Screw top jars, nutrient spike solutions

II. PROCEDURES

A. Winkler Dissolved Oxygen Titration

Once the treated and acidified DO sample is returned to the BEFS lab, it is titrated with sodium thiosulfate titrant (supplied by KHEL). The buret reservoir is kept wrapped with aluminum foil to prevent degradation of the titrant by ambient light.

1. Two hundred mL of the sample to be titrated is decanted into a dedicated 250-mL graduated cylinder. This volume is then poured into a 500-mL Erlenmeyer flask.
2. The buret is pumped to the zero reading at the top of the buret cylinder. Titrant is added to the flask, while "whirling" the flask to thoroughly mix the contents, until the color of the flask contents are "pale straw yellow."

3. One-to-two mL of starch solution are added to the flask, turning the contents blue. Titrant is then added very slowing, while "whirling" the flask, until the solution finally losses all blue color. This can be determined by holding the flask up to a white object, such as a sheet of paper or a white wall.

4. At this point, the DO measure is read from the buret. The milliliters of titrant required equals the DO concentration in the original water sample (mg/L). The flask and cylinder are rinsed with distilled water between samples. Tap water cannot be used as the final rinse water because the free chlorine interferes with the Winkler titration.

B. Chlorophyll-a Determination

1. Within 72 hours of collection, chlorophyll-a samples must be processed. The first step involves filtering the sample, using a Millipore filter manifold and Gelman type A/E glass fiber filters. Each sample consists of a one-liter cubitainer of lake water. All reasonable effort should be made to filter the entire liter, although samples with large amounts of algae or inorganic turbidity may make this impossible. A rule of thumb is to filter for a maximum of 10 minutes for each sample. Date of collection, collection site, and volume filtered are written on a label for each sample.

2. Once filtering is complete, the filter is folded twice and folded within a blotter paper. Standard paper towels work very well by tearing them in three equal pieces, for three blotter papers. The identifying label is taped to the sample, placed (along with up to 7-9 other samples) in a whirl-pack plastic bag, which is then filled with dry-right pellets. The sample packets should be interspersed with the dry-right pellets for maximum contact.

3. Sealed whirl-pack bags of samples are then placed in a freezer, at -20^{O}C, for a minimum of three weeks.

4. After three weeks, but before 15 weeks, have passed, samples are taken out of

the freezer for final analysis. Each sample is processed under reduced lighting conditions from this point onward. Each sample is placed in a glass tissue grinder mortar, along with 4-5 mL of 90 percent acetone and two drops of saturated magnesium carbonate suspension. After complete grinding, the mixture is decanted into a centrifuge tube. Residue is rinsed from the pestle and the mortar with 90 percent acetone, which is added to the centrifuge tube. Care should be taken to end up with 15 mL, or less, in each centrifuge tube.

5. Once the rinsing process is complete, the centrifuge tube is capped tightly, labelled with the lake name and sample number (e.g., Centralia Lake #1), and placed in a tube rack in the dark. All other pertinent information is transferred to the chlorophyll-a analysis form at this time (Appendix C).

6. After a complete rack of samples (10-20) has been ground, the tube rack is placed in the refrigerator, under a light cover, for 24 hours. The following day, the analyses are completed.

7. While centrifuging the samples, the spectrophotometer is allowed to warm up for 30 minutes. Centrifuge tubes are centrifuged for 20 minutes, in groups of six (capacity of the centrifuge), while being allowed to warm to room temperature. Groups of samples may be analyzed as other groups are being centrifuged for efficiency. Care should be taken to correctly balance the centrifuge tubes in the machine to prevent breakage.

8. A pipet is used to transfer 3 mL of each sample into a clean spectrophotometer cuvette. Each cycle of readings can accommodate four samples and a blank. The blank is composed of 100% acetone. Each sample is "read" at 750 nm and 663 nm, after the spectrophotometer is zeroed using the blank at each wavelength. After these two readings are complete, two drops of 0.1 N hydrochloric acid are added to each sample. After waiting 90 seconds, the samples are read at 665 nm and 750 nm. The readings at each wavelength are recorded on the chlorophyll-a analysis form (Appendix C), along with the volume in each centrifuge tube prior to removing the 3 mL aliquot.

9. After the four samples in the spectrophotometer rack are read at the four wavelength settings, they are emptied into a waste jar, rinsed with 90% acetone twice, allowed to dry for 2-3 minutes, polished with Kimwipes, and placed back in the rack. The rack is now ready for the next four samples.

10. After all samples in the run are analyzed, glassware is cleaned and dried, stored for the next run, machinery is turned off and covered with their dust covers, and data may be run through calculations (APHA, 1992) to determine the corrected chlorophyll-a readings of each sample.

11. Calculations utilize the data recorded on the chlorophyll-a analysis form. These calculations are present on the program manager's computer in a LOTUS spreadsheet. Final chlorophyll-a values are recorded on this same sheet.

C. Algal Taxonomy

1. Preserved algae samples are settled upon return from the field. For each sample, a 100-mL aliquot is poured into a glass settling tube. The tube is then corked and labelled with the sample location. Tubes are left undisturbed for 1-2 weeks.

2. At the end of 1-2 weeks, the upper 80 mL of the sample is drawn off using a vacuum hose. The remaining 20 mL of concentrated sample is resuspended and poured into a labelled 25-mL glass vial for long-term storage. Settling tubes are then rinsed and left to dry.

3. When counting algae in a sample, the glass vial is shaken and a sub-sample is placed into the microscope counting cell. The sub-sample should completely fill the counting cell. This is left to settle for about 5 minutes. All genera of algae are counted in 50 fields, selected randomly across the cell. A field is defined by the grid field in the microscope ocular.

4. Once 50 fields have been enumerated, the cell count can be calculated, for each genera, by the use of pre-calculated conversion factors. For 50 fields, counted at 400X, of a 5-fold concentrated sample, the cell count is multiplied by 63. This yields "number of cells/mL."

5. Biovolume is calculated by estimating the mean cell volume of each genera of algae identified. This number is then combined with cell count/mL to generate biovolume in cubic millimeters/mL, ppm, etc. All genera identified, and all calculated cell counts, are recorded onto a specific automated algae data sheet for each lake/wetland sampled (Appendix C).

Nutrient Limiting Algal Bioassay

1. On occasion, it is of value to empirically determine the growth limiting nutrient or factor for the phytoplankton community. A five gallon carbuoy, having been rinsed repeatedly with tap and then distilled water prior to use, is rinsed at the lake in question with ambient water. Using a similarly rinsed one gallon jug, the carbuoy is then filled by repeated filling of the one gallon jug at 0.5 meter depth, and transferring the collected water to the carbuoy.

2. This water is not refrigerated, but is kept as cool as possible out of direct sunlight, until it can be brought back to the KDHE laboratory.

3. The carbuoy of water should be utilized within 24 hours of collection to set up the limiting bioassay.

4. Prior to going to the field to collect water, the bioassay laboratory should be set up. This involves having made sure the fluorescent lights work, bulbs do not need replacement, screw top jars are cleaned using phosphate free detergent, rinsed repeatedly with distilled water, thoroughly dried, and lids have the appropriate label designation. Jars are dedicated to the type of treatment they will receive, for the entire useful life of the jar.

5. Once the bioassay water is returned to the KDHE laboratory, the carbuoy is inverted 8-to-10 times to thoroughly mix the contents. A set of five jars (one out of each treatment set) is then filled with 800 mL of lake water apiece. This sequence is repeated until five sets of five jars have been filled (five per treatment). These five treatments are control, high light treatment, nitrogen added, phosphorus added, and nitrogen plus phosphorus added.

6. Once jars are filled, 1 mL of nitrogen stock solution is added to each jar, the two sets of jars, that will get added nitrogen (in the form of ammonium nitrate). Likewise, 1 mL of phosphorus stock solution is added to each jar, of the two sets of jars, that will get added phosphorus (in the form of potassium phosphate).

7. Light banks are adjusted to provide mean ambient light conditions measured in the top 1.0 meter of the lake when water was collected. A double set of fluorescent lights ▪sandwich• a double row of 10 jars, with a white barrier between the two rows. Light is adjusted by using one, or both, of the lights in each of the banks and/or by adjusting distance between the lights and jars.

The last set of five jars (the high light treatment set) is sandwiched between an identical set of light banks in one row. These should be adjusted to provide at least 2-to-3 times ambient light. Jar positioning in each row is done randomly to start.

8. The lids should be left very loosely on each jar after the bioassay is set up to run for air interchange. Light banks are set to the day/night cycle (to the nearest timer unit) at the time of water collection. A fan is set up in the bioassay room to maintain constant air temperature and prevent the jars from heating excessively.

9. Twice each day (excluding weekends when staff are not present), the jar lids are screwed tight, each jar is shaken gently for ten seconds, and the 4 jars in the middle of each row (for the main light bank set up) are cycled to the ends of the rows. This is done because light intensity does vary slightly along the length of each bulb. For the high light set up, the process is the same except that the five jars are randomized twice each day along the middle portion of the light banks. Remember to loosen all jar lids at the end of this procedure.

10. The bioassay continues thusly, for 9-to-10 days, or until algae growth in some jars is becoming too abundant. At the time the bioassay is broken down, each jar is treated just like a cubetainer of water for any ambient chlorophyll-a sample. The only difference is that each jar should be shaken vigorously to remove any attached algae from the walls of the jar. If need be, a nylon spatula can be used to scrape the jar walls to remove algae into the water. This spatula is cleaned well in distilled water between its use in each jar needing assistance due to attached growth.

11. The 25 chlorophyll-a samples, thus obtained, are treated as indicated in the previous section on chlorophyll-a analysis procedures. All bioassay glassware should then be cleaned in phosphate free detergent, rinsed repeatedly in distilled water, allowed to dry thoroughly, and put in storage until the next bioassay is scheduled.

CHAIN-OF-CUSTODY PROCEDURES FOR STREAM WATER SAMPLES (SCMP-006)

I. INTRODUCTION

Surface water quality data gathered by program staff may be used in agency enforcement actions and other regulatory endeavors. Therefore, appropriate chain-of-custody procedures must be applied to all such samples. Sample custody is initiated at the time of collection. The collector is responsible for the integrity of the samples until they are properly transferred to the receiving laboratory or custody is relinquished to another appropriate sample custodian. The chain-of-custody sheet (or block) is affixed to (located on) all laboratory submission forms (Appendix D).

II. PROCEDURES

A. The sample collector shall complete the collection form indicating the origin of the samples, time and date of collection, bottle numbers and other pertinent field data.

B. When the sample collector or collectors transfer the possession of the samples, the collector must sign the chain-of-custody block or form with indelible ink in the block entitled "Relinquished By (signature)". The transfer action takes place at the actual time the samples are delivered into laboratory control.

C. The designated laboratory custodian at the laboratory will sign the block entitled "Received by (signature)" recording the time and date on the field sheet that the samples are received.

D. If samples are delivered to KHEL after normal working hours, the samples must be stored in secured storage area that has been approved by the laboratory. The chain-of-custody must be completed the next working day before the samples can be officially accepted by the laboratory.

E. Once the chain-of-custody forms have been completed a copy is retained by the sample collector for the OSS file.

MAINTENANCE PROCEDURES FOR FIELD SAMPLING EQUIPMENT (SBMP-001)

I. INTRODUCTION

A. Purpose

Field equipment must be maintained in a reliable working condition to maximize the efficiency of macroinvertebrate collection activities and minimize the loss of data.

B. Equipment/Accessories

1. Hip and chest waders
2. D-frame aquatic nets

II. PROCEDURES

A. Hip and chest waders

1. Waders are stored in a hanging position in a cool, dark area to reduce cracking.
2. Rips and tears are repaired with silicone seal or adhesive patches, depending on the extent of damage and wader construction.
3. Mud is removed prior to storage.
4. Insides of hip and chest waders are kept dry to reduce deterioration of lining material.

B. D-frame aquatic nets

1. Nets are checked for damage after each sampling event.
2. Rips and tears are repaired with silicone seal or sewn closed.
3. Depth graduations on the handles eventually fade and must be retraced from time to time with indelible marker.

PROCEDURES FOR COLLECTION OF MACROINVERTEBRATE SAMPLES (SBMP-003)

I. INTRODUCTION

A. Purpose

Staff involved in the collection of macroinvertebrate samples must adhere to a standardized sampling procedure to maximize the comparability of the data generated by different workers over a potentially long period of time. Consistent procedures reduce the statistical "noise" that could otherwise detract from the utility of the data.

B. Equipment/Accessories

1. D-frame aquatic net with centimeter graduations on handle for depth determination

2. Glass samples jars (120 ml) containing 70-80% ethanol (approximately 50 ml per jar)

3. Forceps (fine point with lanyard)

4. Hip or chest type waders depending on the depth and flow conditions of the stream being sampled

II. PROCEDURES

A. During each sampling event, macroinvertebrate specimens are collected by two workers over a period of thirty consecutive minutes (a combined duration of one person-hour).

B. All available macrohabitats (riffles, pools, runs) and microhabitats are sampled, as permitted by size of water body and the time allotted (see SOP No. SBMP-005).

C. Macroinvertebrate specimens are collected by:
1. kicking riffles and leaf packets and allowing the current to carry dislodged organisms (and debris on which organisms may occur) into the D-frame nets for removal with forceps;

2. sweeping the D-frame nets through submerged or floating aquatic vegetation, submersed terrestrial vegetation and tree roots, accumulations of woody debris, and growths of filamentous algae;

3. sieving fine sediments (silt and fine sand) through the D-frame nets; and

4. using forceps to directly pick organisms from logs, large rocks, or other surfaces not easily dislodged by kicking.

D. Each worker endeavors to collect at least 100 organisms, for a combined (pooled) total of 200 or more organisms per sample. When multiple habitats are present, no more than 50 orgnisms should be collected from any single microhabitat.

E. Different macroinvertebrate taxa present at the site are collected in numbers roughly proportional to their relative abundance in the stream community.

F. As specimens are separated from debris, they are placed directly into the glass sample jars containing 70-80% ethanol. The sample jars are labeled with the station number and collection date, using an indelible marker and white label marking tape.

G. Upon completion of the sampling effort, a field collection form is filled out by one of the workers (Appendix C). Information recorded on the form includes station number and location, time and date of sample collection, names of sample collectors, and flow conditions at the time of sampling.

III. SAFETY

A. Field crews shall consist of two or more individuals. Crew members shall be certified in adult cardiopulmonary resuscitation and basic first aid by the American Red Cross or equivalent institution. Any lapse in certification shall render an employee ineligible for macroinvertebrate sampling activities, pending renewal of certification.

B. If current velocity exceeds 10 cm/sec, field workers shall not attempt to wade through waters greater than one meter in depth (or above crotch level in chest waders). Wading in stronger currents shall be limited to waters less than knee deep. Workers must remain cognizant of the inherent danger of strong currents, regardless of water depth. Additional caution is required when walking on algal-coated rocks or other slippery surfaces.

C. Workers shall not attempt to enter streams under conditions of high runoff, when water is flowing outside the normal channel and bottom conditions may be less stable and predictable.

D. Workers shall not enter streams or engage in any macroinvertebrate sampling activities if lightning is observed.

E. Workers shall avoid wading in excessively deep water, where even slight, unexpected increases in depth may result in overtopping of waders.

PROCEDURES FOR PREPARATION, IDENTIFICATION, ENUMERATION AND PRESERVATION OF BIOLOGICAL SPECIMENS (SBMP-004)

I. INTRODUCTION

A. Purpose

Procedures employed in the identification and enumeration of macroinvertebrate samples and preservation of voucher specimens are described in this SOP.

B. Equipment/accessories

1. Bausch and Lomb 10X-70X variable zoom dissecting microscope with Dyonics, dual fiber optic, variable intensity light source or equivalent light source

2. Baush and Lomb 40X-400X variable magnification compound microscope with integral light source or equivalent light source

3. Glass or plastic Petri dishes, coarse and fine point dissection probes, fine and extra fine forceps

4. Specimen vials, specimen vial trays, solution of 70-80% ethanol and 5% glycerine, reference collection housed in locking storage cabinet

5. Microscope slide storage boxes, microscope slides, microscope slide cover slips, Euparal mounting and clearing medium, glycerine, hot plate for drying and curing slide mounts

6. Taxonomic keys and supporting references

II. PROCEDURES

A. Identification and enumeration of macroinvertebrate samples in the laboratory begins with completion of the biological data form (Appendix C). Station number and location, collection date, and collectors' names are transcribed from the sample jar and field collection form. The examination date and name of examiner are likewise

recorded on the biological data form.

B. Contents of the two jars that make up a sample are pooled in one or two Petri dishes. Extraneous debris is removed and the organisms are presorted with the unaided eye into various phylogenetic groups (order, family or genus).

C. After preliminary sorting, the organisms are examined individually with a dissecting microscope and further sorted, identified and enumerated on the biological data form.

D. Certain taxonomic groups, small specimens, and certain anatomical features of some groups may need to be mounted on a microscope slide and examined under higher magnification (midge head capsules, early instars, mayfly gills, riffle beetle male genitalia, etc.). Euparal mounting medium is used to clear chitin and permanently mount midge head capsules for identification to the genus level. Euparol mounts are cured with gentle heat from a hot plate.

E. An attempt is made to identify all specimens to the lowest practicable taxonomic level, generally genus or species. Taxonomic works written specifically for the fauna of the state or region are preferentially utilized. Unusual or unprecedented determinations are compared to comprehensive lists of macroinvertebrate species known to occur in Kansas. These lists are maintained by SBSK.

F. A reference collection is maintained of all aquatic macroinvertebrate taxa encountered historically in the monitoring program. This collection is helpful when working with difficult groups or less frequently encountered species, and it provides a valuable training and educational tool. Many specimens included in the collection have been identified or confirmed by experts at SBSK.

G. After specimens have been identified and enumerated, pooled samples are transferred to storage and maintained there for a minimum of two years.

H. Microscopes must have dust covers in place at all times when not in use. Cleaning of optics is performed with lens tissue and, if necessary, cleaning solvent. The condenser on the compound microscope is periodically adjusted to maintain maximum performance and resolution.

PROCEDURES FOR COMPLETION OF HABITAT DEVELOPMENT INDEX FORM (SBMP-005)

I. INTRODUCTION

A. Purpose

This SOP provides instructions for the completion of the Habitat Development Index or "H.I." form (Form App.C-2). The form is competed in the field upon conclusion of biological (macroinvertebrate) collection activities. The resulting H.I. score is a numerical expression of the capacity of a stream to support a diverse biological community in the absence of water pollution problems or other significant perturbations. When compared among sites, the score is useful in accounting for the possible effects of habitat differences on biotic index values.

B. Equipment/Accessories

1. Measuring pole or D-frame aquatic net with handle graduated in centimeters

2. Hip or chest waders, depending on water depth and prevailing flow conditions

II. CALCULATION PROCEDURES

A. Minimum Macrohabitat Score

Each of the three types of macrohabitats (riffle, pool, run) are scored as a "3" if present in the stream and sampled; if a macrohabitat is not present or sampled, it is given a score of "0."

B. Average Depth

Average depth of each of the macrohabitats sampled is rated as a "0", "1" or "2" according to the average depth categories on the H.I. form.

C. Riffle Substrate Score

This score evaluates the habitat provided by a riffle in terms of the quality and

quantity of cobble present. Quality is defined as degree of embededness. Quantity is defined as the percentage of cobble in the riffle. Embededness which inhibits macroinvertebrate colonization is the only H.I. parameter which may actually lower the riffle quality score and overall H.I. score.

D. Organic Detritus and Debris

The types and quantity of organic debris actually sampled within each macrohabitat are collectively rated as "0", "1", "2" or "3." Examples of organic debris are indicated on the H.I. form. For the purposes of this form, a "log" is considered to be any woody debris greater than 2.5 inches (24 cm) in diameter.

E. Algal Masses

Algal growths which provide some macroinvertebrate habitat are rated "0" for absence and "1" for presence in each of the macrohabitats sampled. (Periphytic growths are rated "0", as they constitute food for grazers but provide little shelter.)

F. Macrophytes

Macrophytic vegetation provides habitat and is rated "0", "1" or "2" according to absence or presence and quantity within each of the macrohabitats sampled. Examples of macrophytes that provide macroinvertebrate habitat are provided on the H.I. form.

G. Bank Vegetation

Bank vegetation provides habitat and is rated "0", "1" or "2" according to absence or presence and quantity within each of the macrohabitats sampled. Examples of bank vegetation that provide suitable habitat are provided on the H.I. form.

H. Final Habitat Score

Scores are totaled for each of the macrohabitats sampled, and subtotals are totaled to derive the final H.I. score.

APPENDIX C

STANDARDIZED PHYSICO-CHEMICAL FIELD SHEETS AND SAMPLE SUBMISSION FORMS

KANSAS SURFACE WATER USE DESIGNATION PROGRAM APPENDIX C

STANDARD OPERATING PROCEDURES COMPLIANCE MONITORING PROGRAM

TABLE OF CONTENTS

Section	Revision No.	Date
INORGANIC, ORGANIC, AND RADIOLOGICAL SAMPLE LABORATORY SUBMISSION FORM WITH CHAIN-OF-CUSTODY BLOCK (FORM APP. C-1)	0	6/97
BACTERIOLOGICAL SAMPLE LABORATORY SUBMISSION FORM WITH CHAIN-OF-CUSTODY BLOCK (FORM APP. C-2)	0	10/00

Kansas Department of Health and Environment
Division of Health and Environmental Laboratories
Forbes Field, Building 740
Topeka, Kansas 66620-0001

Lab Number: _____
Date Received: _____
Analysis Code: _____

Sample Submission Form

Report To: _____ **Address:** _____

Collection Site: _____
Legal Project Code Name PWS Acct. No.

Site ID Number: ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ **Collection Depth:** ___ ___ Feet ___ ___

Sample Type: Water Soil Sediment Sludge Air Oil Solid Liquid Wipe **Priority:** Regular Moderate Urgent

Sample Collector: _____ **Date:** __ __ __ **Time:** __ __ __ __
Name Agency (Abbr) Mo Day Yr 24 Hour

Program Code:

EA	EB	EC	ED	EE	EF	EG	EJ	EL	EP	ER	ET	EW	ES	FK	LM	SC	SE	SG	SN	SP	SW	PC
PD	PE	PG	PI	PL	PP	PT	PU	PV	WE	WI	HD	HF	HL	HS	RP	AR	GS	KC	US	AQ	RT	WC

Organic Chemistry Laboratory

Check Desired Analysis: ☐ Other _____ VOC Sample Acidified: ☐

☐ Volatiles Method: ☐ 624 ☐ 8260 ☐ 524.2 ☐ Pesticides Method: ☐ 608 ☐ 8080 ☐ 507/8

☐ Acids Method: ☐ 625 ☐ 8270 ☐ Base/Neutrals Method: ☐ 625 ☐ 8270 ☐ 525.2

☐ PCB's Method: ☐ 608 ☐ 8080 ☐ Oil ☐ Herbicides Method: ☐ 615 ☐ 8150 ☐ 515.1

Inorganic Chemistry Laboratory

Bottle Nos.: Chem _____ DO _____ NUT _____ HM _____ CN _____ O&G _____ Phenol _____

Check Desired Analysis: ☐ Other _____

☐ Metals ☐ Mercury ☐ Mineral ☐ TCLP

Radiation Chemistry Laboratory

Check Desired Analysis: ☐ Other _____

☐ Gross Alpha ☐ Gross Uranium ☐ Ra-226 ☐ Ra-228

Sample Comments: _____

Chain of Custody:

Date _____ Relinquished By _____ Received By _____

Date _____ Relinquished By _____ Received By _____

Date _____ Relinquished By _____ Received By _____

Additional Reports Routed To:

Name _____ Address _____

Name _____ Address _____

Name _____ Address _____

DHEL-09/99

Instructions for this form are printed on the reverse side

Form C-1

Form C-2

KANSAS DEPARTMENT OF HEALTH AND ENVIRONMENT
DIVISION OF ENVIRONMENT

PROJECT OR LOCATION : Compliance Monitoring

Account Number: 4EM30

COLLECTOR (S) :_____

COLLECTION DATE:_____

FACILITY	LAB ID NO	STA. NO	TIME	TEMP C	BOTTLE NUMBERS					ORGANICS	FIELD pH	FLUORIDE	ELISA ATRAZINE	REMARKS
					HEAVY METAL	DO	CHEM & BOD	BACT	NH3					

CHAIN OF CUSTODY

DATE RECEIVED: RECEIVED FROM: RECEIVED BY:

_____ _____ _____

_____ _____ _____

_____ _____ _____

SEND REPORT TO:

_____

_____

_____

APPENDIX D

STANDARDIZED BIOLOGICAL FIELD AND TAXONOMIC FORMS FOR STREAM, LAKE, AND WETLAND CHARACTERIZATION

KANSAS SURFACE WATER USE DESIGNATION PROGRAM

APPENDIX D

TABLE OF CONTENTS

APPENDIX D

TABLE OF CONTENTS

Stream Habitat Assessment Field Data Sheet
(Front)

Stream Name:		Location:	
Station #:	Rivermile:	Legal Descr:	
Lat:	Long:	River Basin:	
Storet #:		Agency:	
Investigators:			
Form Completed By:		Date:	Reason For Survey:
		Time: AM PM	

Habitat Parameter	Conditions Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of new fall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
2. Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
4. Sediment Deposition/ Embeddedness	Little or no enlargement of islands or point bars and less than 5% (20% for low-gradient streams) of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% (20-50% for low-gradient) of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% (50-80% for low-gradient) of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% (80% for low-gradient) of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or >25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.

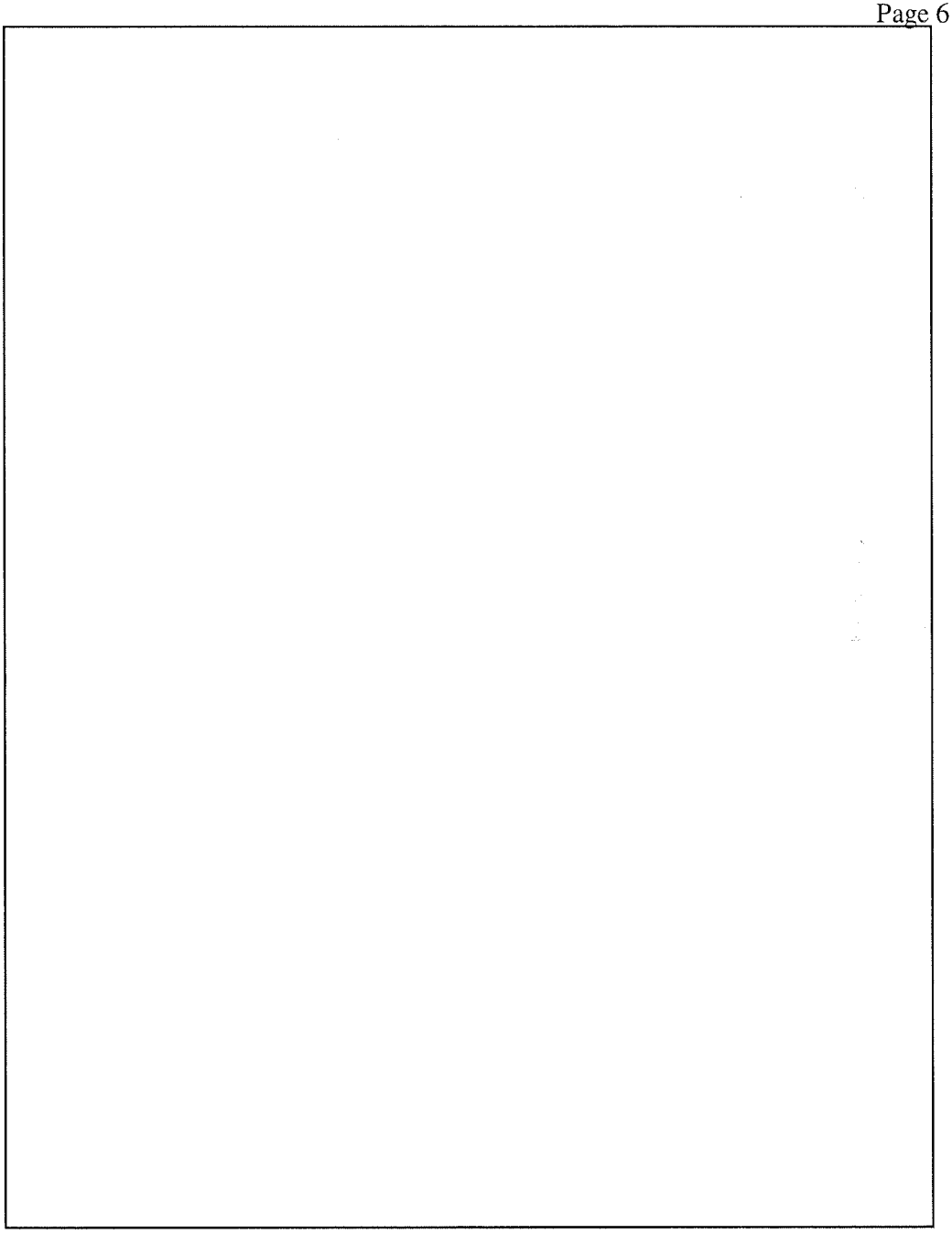
Stream Habitat Assessment Field Data Sheet
(Back)

Habitat Parameter	Conditions Category			
	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note: channel braiding is considered normal in sandy bottomed streams, esp. in W. Kansas) This parameter is not easily rated in these areas.	The bends in the stream increase the stream length 2 to 3 times longer than if it was in a straight line	The bends in the stream increase the stream length 1 to 2 time longer than if it was in a straight line	Channel straight; waterway has been channelized for a long distance.
8. Bank Stability (score each bank) Note: determine left or right side by facing downstream.	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. < 5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60- 100% of bank has erosional scars.
left bank				
right bank				
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody grasses; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
left bank				
right bank				
10. Riparian Vegetative Zone (score each bank) Note: determine left or right side by facing downstream.	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters; little or no riparian vegetation due to human activities.
left bank				
right bank				

Lake Physical Characterization/Water Quality Field Data Sheet
(Back)

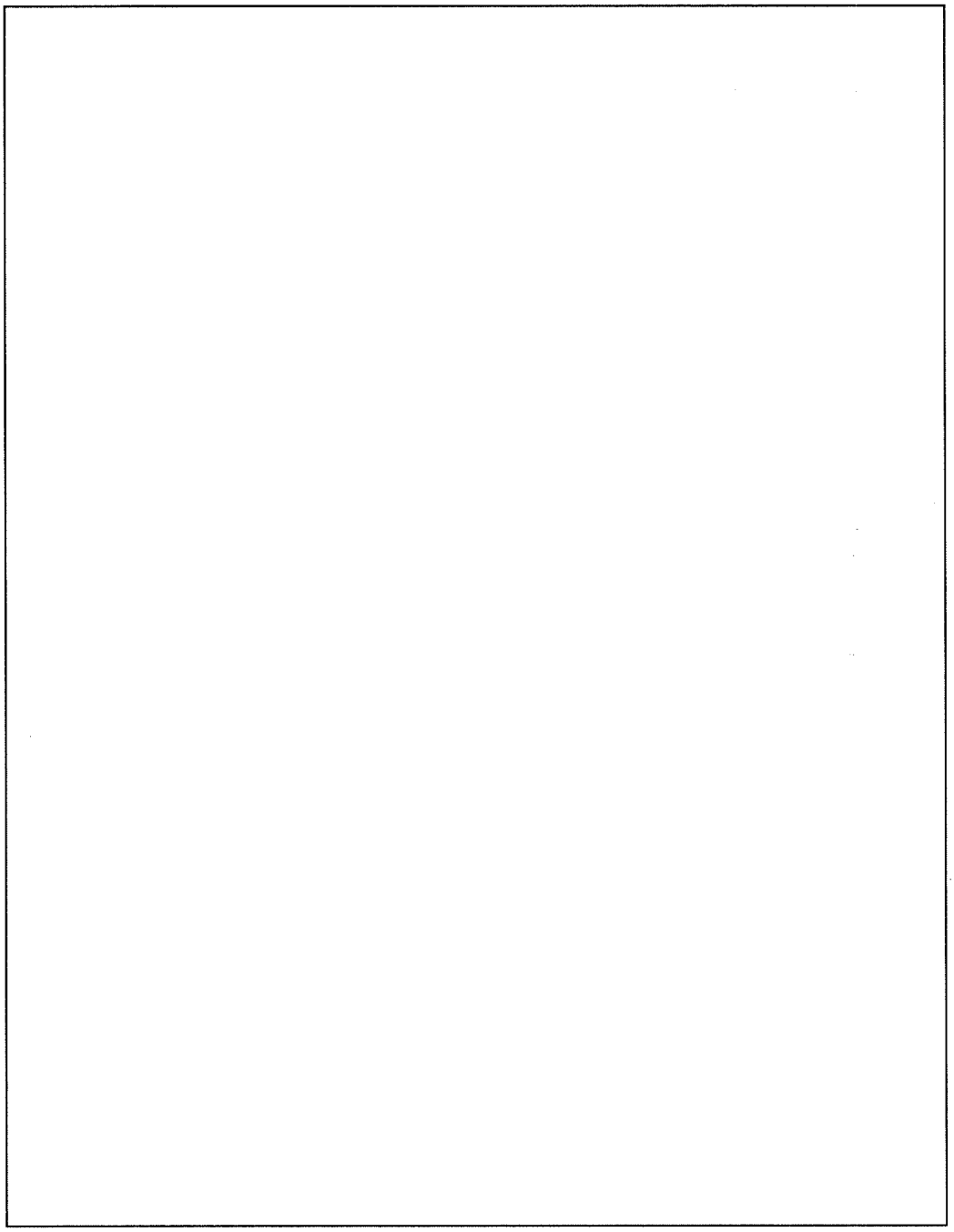
Watershed Features	**Predominant Surrounding Landuse (%)** Forest _____ Commercial _____ Field/Pasture _____ Industrial _____ Agricultural _____ Other _____ Residential	**Local Watershed NPS Pollution** O No evidence O Some potential sources O Obvious sources **Local Watershed Erosion** O None O Moderate O Heavy
Riparian Vegetation (18 meter buffer)?	**Indicate the dominant type and record the dominant species present** O Trees O Shrubs O Grasses O Herbaceous O None **dominant species present:** _____	
Aquatic Vegetation	**Indicate the dominant type and record the dominant species present** O Rooted emergent O Rooted submergent O Rooted floating O Free floating O Floating Algae O Attached Algae **dominant species present:** _____ **Portion of the reach with aquatic vegetation: % cover % volume infested**	
Water Quality	**Temperature:** _____ C **Dissolved Oxygen:** _____ **Specific Conductance:** _____ **Secchi Depth:** _____ **Nutrients:** **Total N:** _____ **pH:** _____ **Total P:** _____ **Turbidity:** _____ **Chlorophyll:** _____ **WQ Instrument Used:** _____ **Other WQ Samples Collected:** Y N	**Water Odors** O Normal/None O Sewage O Petroleum O Chemical O Fishy O Other _____ **Water Surface Oils** O Slick O Sheen O Globs O Flecks O None O Other _____ **Turbidity (if not measured** O Color _____ O Clear O Slightly turbid O Turbid O Opaque O Stained O Other
Sediment/ Substrate	**Odors** O Normal O Sewage O Petroleum O Chemical O Anaerobic O None O Other _____ **Oils** O Absent O Slight O Moderate O Profuse	**Deposits** O Sludge O Sawdust O Paper fiber O Sand O Relic shells O Other _____ **Looking at stones which are not deeply embedded, are the undersides black in color?** O Yes O No

Inorganic Substrate Components/Embeddedness (should add up to 100%)			Organic Substrate Components (does not necessarily add up to 100%)		
Substrate Type	Diameter	% Composition in Sampling Reach	Substrate Type	Characteristic	% Composition in Sampling Area
Bedrock			Detritus	sticks, wood, coarse plant materials (CPOM)	
Boulder	> 256 mm (10")				
Cobble	64-256 mm (2.5-10")				
Gravel	2-64 mm (0.1-2.5")		Muck-Mud	black, very fine organic (FPOM)	
Sand	0.06-2 mm (gritty)				
Silt	0.004-0.06 mm		Marl	grey, shell fragments	
Clay	< 0.004 mm (slick)				



Form D-3 (p. 2)

Form D-4



Wetland Use Attainability Analysis Form: Basic Biological and Ecological Data — Page 2 of 3

Population Within Watershed: _____
NPDES Dischargers in Watershed: _____

List Dischargers: _____

Watershed Land Use Composition:	Cropland	_____	acres
	Pasture/Grassland	_____	acres
	Urban	_____	acres
	Animal Confinement	_____	acres
	Wooded/Natural/Water	_____	acres
	Other _____	_____	acres
	Total	_____	acres
Riparian/Shoreline Vegetation: Percent Cover Along Shoreline		_____	percent shoreline
Composition of Riparian Vegetation:	Percent Trees/Shrubs	_____	%
	Percent Grasses/Forbs	_____	%
	Percent Other	_____	%
Predominant Substrate Type: (Check One)	Sand	_____	
	Silt/Mud	_____	
	Clay	_____	
	Cobble	_____	
Emergent Plant Zone:	Percent Cover Over Entire Wetland	_____	%
	Percent Cover In Primary Pool	_____	%
	Dominant Genera	_____	
		_____	
		_____	
Submersed/Floating Leaved Zone:	Percent Cover Over Entire Wetland	_____	%
	Percent Cover In Primary Pool	_____	%
	Dominant Genera	_____	
		_____	
		_____	
Vegetation/Water Interspersion: (Check One) (Interspersion of Plant Stands and Open Water)	1- Low	_____	
	2 - In Between 1 and 3	_____	
	3 - Even Mixture	_____	
	4- In Between 3 and 5	_____	
	5 - High	_____	
Vegetation Form Richness: (Check One) (Richness of Growth Forms Such As Woody, Broad Leaved, Reed-Like, Etc.)	1- Low	_____	
	2 - In Between 1 and 3	_____	
	3 - Even Mixture	_____	
	4- In Between 3 and 5	_____	
	5 - High	_____	

Form D-5 (p. 1)

Form D-5 (p. 2)

Wetland Use Attainability Analysis Form: Basic Biological and Ecological Data — Page 3 of 3

Physical Habitat Interspersion: (Check One) (Variety of Flow, Depth, and Substrate Interspersion)	1- Low	____
	2 - In Between 1 and 3	____
	3 - Even Mixture	____
	4- In Between 3 and 5	____
	5 - High	____
Vegetation Class Interspersion: (Check One) (Interspersion of Various Vegetation Growth Forms)	1- Low	____
	2 - In Between 1 and 3	____
	3 - Even Mixture	____
	4- In Between 3 and 5	____
	5 - High	____

Wetland Class (Based on National Wetland Inventory, Cowardin, et al., 1979)

System Classification (Check One):

Riverine Lower Perennial (within a channel, low gradient, low velocity)	____
Riverine Upper Perennial (within a channel, higher gradient, higher velocity)	____
Riverine Intermittent (within a channel, flow is not year-round but may be pooled during low flow)	____
Lacustrine Limnetic (depressional, <30% plant cover, >20 acres, and >2 meters maximum depth	____
Lacustrine Littoral (as above, but maximum depth <2 meters)	____
Palustrine (as above, but <20 acres, <2 meters maximum depth, typically vegetation rich but not required)	____

Class: (Check One Under The Appropriate System Type)	Riverine Systems:	Rock Bottom	____
		Unconsolidated Bottom	____
		Aquatic Bed	____
		Rocky Shore	____
		Unconsolidated Shore	____
		Emergent Wetland (lower perennial only)	____
		Streambed (intermittent systems only)	____
	Lacustrine Systems:	Rock Bottom	____
		Unconsolidated Bottom	____
		Aquatic Bed	____
		Rocky Shore (littoral only)	____
		Unconsolidated Shore (littoral only)	____
		Emergent Wetland (littoral only)	____
	Palustrine Systems:	Rock Bottom	____
		Unconsolidated Bottom	____
		Aquatic Bed	____
		Unconsolidated Shore	____
		Emergent Wetland	____
		Scrub/Shrub Wetland	____
		Forested Wetland	____

Water Regime Modifiers: (Check One)	Permanently Flooded	____
	Semipermanently Flooded (all year most years)	____
	Seasonally Flooded (water for extended period, dry by end of year)	____
	Saturated (saturated year-round, but open water rare)	____
	Temporarily Flooded (open water for brief periods in growing season	____
	Intermittently Flooded (substrate usually exposed)	____
	Artificially Flooded (controlled by structures)	____

Average Specific Conductance: _____ umho/cm

Average pH: _____ S.U.

Form D-5 (p. 2)

FISH COLLECTIONS:

Station _____

Collectors_____

_____

Date _____ Water Temperature_____

Seines Used: _____ ft. area_____

_____ ft. area_____

Fish collection preserved?_____

Identified by:_____

Comments:_____

_____

_____

_____

_____

_

Species account:

Species	Number Kept	Number Released

STREAM BIOLOGICAL MONITORING PROGRAM

FIELD COLLECTION FORM

Date_____ Collector(s)_____
Time:
Beginning_____
Ending_____

Station #_____

Location_____

_____

Legal Description: ___,___,___,SEC._____,T_____,R_____

County_____

Temperature: Air_____ Water_____

Dissolved Oxygen Bottle #_____

Mussel Collection (check)_____

Flow Conditions (check one): High (>1' above normal low flow)_____
Normal Low Flow_____
Extreme Low Flow_____

Remarks_____

_____

_____

_____

_____

_____

_____

FORM SBMP C-1

Habitat Development Index

Stream_____ Station No._____ Date_____

County_____ Legal description_____

Location _____ Evaluator_____

Score only those macro and microhabitat categories that were sampled.

					Riffle	Pools	Runs
MINIMUM MACRO-HABITAT SCORE	Absent 0		Present 3				
AVERAGE DEPTHS	Riffles	<5 cm 0	5-10 cm 1	>10 cm 2			
	Pools	<30 cm 0	30-60 cm 1	>60 cm 2			
	Runs	<15 cm 0	15-45 cm 1	>45 cm 2			
RIFFLE SUBSTRATE SCORE	% Cobble(1)	0-10% 0	11-25% 1	26-30% 2	>50% 3	A	
	% Embeddedness	0-25% 0	26-75% -1	>75% -3		B	
	Record score in right hand column only if A + B ≥ zero.					A + B	
ORGANIC DETRITUS AND DEBRIS (2)	No organic detritus or debris was sampled. 0	Only sparsely scattered bits of detritus were sampled. 1	Large leaf packs or large amounts of scattered detritus were sampled. 2	Both detritus and debris including logs were sampled. 3			
ALGAL (3) MASSES	No algal masses were sampled. 0	Algal masses were sampled. 1					
MACROPHYTES (4)	No macrophytes were sampled. 0	Very few macrophytes or small patches of plants were sampled. 1	Many macrophytes or large areas of dense growth were sampled. 2				
BANK (5) VEGETATION	No bank vegetation was sampled. 0	Only small amounts of thin bank vegetation was sampled. 1	Submerged tree roots or thick bank vegetation was sampled. 2				

(1)If percent cobble is ≤10% and boulders or bedrock are present, score box A as a 1. Cobble is defined as particles between 6 and 26 cm in diameter.
(2)Organic detritus includes seeds, pods, leaves, small bark, twigs, leaf fragments, may accumulate into piles or packs. Organic debris includes larger sticks, bark, and logs.
(3)Algal masses should be sampled if they provide habitat and not just food.
(4)Macrophytes include floating-leaved, emergent, or submerged aquatic plants.
(5)Bank vegatation includes submerged terrestial plants, tree limbs, and roots.

MACROHABITAT SCORES ___+___+___

SAMPLE SCORE

FORM SBMP C-2

KDHE/BEFS

IDENTIFICATION BENCH SHEET

STATION_____ STREAM/LOCATION_____

DATE COLLECTED_____ DATE EXAMINED_____ DETERMINED BY_____

COLLECTOR(S)_____ TYPE OF SAMPLE (EFFORT)_____

	KBS CODE #	A #	N #	L #	P #	TOTAL #		KBS CODE #	A #	N #	L #	P #	TOTAL #
COLEOPTERA							MEGALOPTERA						
							ODONATA						
							PLECOPTERA						
DIPTERA													
							TRICHOPTERA						
							CRUSTACEA						
EPHEMEROPTERA													
							GASTROPODA						
							HIRUDINEA						
							OLIGOCHAETA						
							PELECEPODA						
							TURBELLARIA						
HEMIPTERA													
							OTHER						

KBS CODE#=KDHE KANSAS BIOSYSTEM TAXON UNIQUE CODE A#=NUMBER OF ADULTS IN SAMPLE
N#=NUMBER OF NYMPHS IN SAMPLE L#=NUMBER OF LARVAE IN SAMPLE
P#=NUMBER OF PUPAE IN SAMPLE

TOTAL ORGANISMS_____ TOTAL TAXA_____ EPT INDEX_____ MBI_____ MBI(N)_____ HDI_____ D.O._____

SHEET_____ OF_____

FORM SBMP C-3

APPENDIX E

STATE OF KANSAS SPECIES IN NEED OF CONSERVATION (SINC) AND THREATENED & ENDANGERED (T&E) SPECIES

KANSAS SURFACE WATER USE DESIGNATION PROGRAM

APPENDIX E

TABLE OF CONTENTS

KANSAS

Species In Need of Conservation

(SINC)

INVERTEBRATES

Creeper Mussel,	*Strophitus undulatus*
Cylindrical Papershell Mussel,	*Anodontoides ferusscianus*
Delta Hydrobe,	*Probythinella emarginata*
Deertoe Mussel,	*Truncilla truncata*
Fatmucket Mussel,	*Lampsilis siliquoidea*
Fawnsfoot Mussel,	*Truncilla donaciformis*
Gray Petaltail Dragonfly,	*Tachopteryx thoreyi*
Neosho Midget Crayfish,	*Orconectes macrus*
Ozark Emerald Dragonfly,	*Somatochlora ozarkensis*
Prairie Mole Cricket,	*Gryllotalpa major*
Round Pigtoe Mussel,	*Pleurobema sintoxia*
Snuffbox Mussel,	*Epioblasma triquetra*
Spike Mussel,	*Elliptio dilatata*
Wabash Pigtoe Mussel,	*Fusconaia flava*
Wartyback Mussel,	*Quadrula nodulata*
Washboard Mussel,	*Megalonaias nervosa*
Yellow Sandshell Mussel,	*Lampsilis teres*

FISH

Banded Darter,	*Etheostoma zonale*
Banded Sculpin,	*Cottus carolinae*
Bigeye Shiner,	*Notropis boops*
Black Redhorse,	*Moxostoma duquesnei*
Blacknose Dace,	*Rhinichthys atratulus*
Blue Sucker,	*Cycleptus elongatus*
Bluntnose Darter,	*Etheostoma chlorosoma*
Brassy Minnow,	*Hybognathus hankinsoni*
Brindled Madtom,	*Noturus miurus*
Cardinal Shiner,	*Luxilus cardinalis*
Common Shiner,	*Luxilus cornutus*
Gravel Chub,	*Erimystax x-punctatus*
Greenside Darter,	*Etheostoma blennioides*

Highfin Carpsucker,	*Carpiodes velifer*
Johnny Darter,	*Etheostoma nigrum*
Lake Sturgeon,	*Acipenser fulvescens*
Northern Hog Sucker,	*Hypentelium nigricans*
Ozark Minnow,	*Notropis nubilus*
Plains Minnow,	*Hybognathus placitus*
Redfin Darter,	*Etheostoma whipplei*
River Darter,	*Percina shumardi*
River Redhorse,	*Moxostoma carinatum*
River Shiner,	*Notropis blennius*
Southern Redbelly Dace,	*Phoxinus erythrogaster*
Slough Darter,	*Etheostoma gracile*
Speckled Darter,	*Etheostoma stigmaeum*
Spotfin Shiner,	*Cyprinella spiloptera*
Spotted Sucker,	*Minytrema melanops*
Stippled Darter,	*Etheostoma punctulatum*
Striped Shiner,	*Luxilus chrysocephalus*
Tadpole Madtom,	*Noturus gyrinus*

AMPHIBIANS

Crawfish Frog,	*Rana areolata*
Red-spotted Toad,	*Bufo punctatus*

REPTILES

Alligator Snapping Turtle,	*Macrochelys temminckii*
Eastern Hognose Snake,	*Heterodon platirhinos*
Glossy Snake,	*Arizona elegans*
Night Snake,	*Hypsiglena torquata*
Rough Earth Snake,	*Virginia striatula*
Timber Rattlesnake,	*Crotalus horridus*
Western Hognose Snake,	*Heterodon nasicus*

BIRDS

Black Rail,	*Laterallus jamaicensis*
Black Tern,	*Chlidonias niger*
Bobolink,	*Dolichonyx oryzivorus*
Cerulean Warbler,	*Dendroica cerulea*
Chihuahuan Raven,	*Corvus cryptoleucus*
Curve-billed Thrasher,	*Toxostoma curvirostre*
Ferruginous Hawk,	*Buteo regalis*
Golden Eagle,	*Aquila chrysaetos*
Henslow's Sparrow,	*Ammodramus henslowii*
Ladder-backed Woodpecker,	*Picoides scalaris*
Long-billed Curlew,	*Numenius americanus*

Mountain Plover,	*Charadrius montanus*
Short-eared Owl,	*Asio flammeus*
Whip-poor-will,	*Camprimulgus vociferus*
Yellow-throated Warbler,	*Dendroica dominica*

MAMMALS

Franklin's Ground Squirrel,	*Spermophilus franklinii*
Pallid Bat,	*Antrozous pallidus*
Southern Bog Lemming,	*Synaptomys cooperi*
Southern Flying Squirrel,	*Glaucomys volans*
Texas Mouse,	*Peromyscus attwateri*
Townsend's Big-eared Bat,	*Corynorhinus townsendii*

KANSAS

Threatened & Endangered Species

(T&E)

THREATENED

INVERTEBRATES

Butterfly Mussel,	*Ellipsaria lineolata*
Delta Hydrobe,	*Probythinella emarginata*
Flutedshell Mussel,	*Lasmigona costata*
Ouachita Kidneyshell Mussel,	*Ptychobranchus occidentalis*
Rock Pocketbook Mussel,	*Arcidens confragosus*
Sharp Hornsnail,	*Pleurocera acuta*

FISH

Arkansas Darter,	*Etheostoma cragini*
Blackside Darter,	*Percina maculata*
Chestnut Lamprey,	*Ichthyomyzon castaneus*
Flathead Chub,	*Platygobio gracilis*
Hornyhead Chub,	*Nocomis biguttatus*
Neosho Madtom,	*Noturus placidus*
Plains Minnow,	*Hybognathus placitus*
Redspot Chub,	*Nocomis asper*
Shoal Chub,	*Macrhybopsis hyostoma*
Silverband Shiner,	*Notropis shumardi*
Sturgeon Chub,	*Macrhybopsis gelida*
Topeka Shiner,	*Notropis topeka*
Western Silvery Minnow,	*Hybognathus argyritis*

AMPHIBIANS

Eastern Newt,	*Notophthalmus viridescens*
Eastern Narrowmouth Toad,	*Gastrophryne carolinensis*
Green Frog,	*Rana clamitans*
Green Toad,	*Bufo debilis*
Longtail Salamander,	*Eurycea longicauda*
Spring Peeper,	*Pseudacris crucifer*

Strecker's Chorus Frog,	*Pseudacris streckeri*

REPTILES

Broadhead Skink,	*Eumeces laticeps*
Checkered Garter Snake,	*Thamnophis marcianus*
Common Map Turtle,	*Graptemys geographica*
Longnose Snake,	*Rhinocheilus lecontei*
Redbelly Snake,	*Storeria occipitomaculata*
Smooth Earth Snake,	*Virginia valeriae elegans*
Texas Blind Snake,	*Leptotyphlops dulcis*

BIRDS

Piping Plover,	*Charadrius melodus*
Snowy Plover,	*Charadrius alexandrinus*

MAMMALS

Eastern Spotted Skunk,	*Spilogale putorius*

ENDANGERED

INVERTEBRATES

American Burying Beetle,	*Nicrophorus americanus*
Ellipse Mussel,	*Venustaconcha ellipsiformis*
Elktoe Mussel,	*Alasmidonta marginata*
Flat Floater Mussel,	*Anodonta suborbiculata*
Mucket Mussel,	*Actinonaias ligamentina*
Neosho Mucket Mussel,	*Lampsilis rafinesqueana*
Optiosevus Riffle Beetle,	*Optioservus phaeus*
Rabbitsfoot Mussel,	*Quadrula cylindrica*
Slender Walker Snail,	*Pomatiopsis lapidaria*
Western Fanshell Mussel,	*Cyprogenia aberti*

FISH

Arkansas River Shiner,	*Notropis girardi*
Arkansas River Speckled Chub,	*Macrhybopis tetranema*
Pallid Sturgeon,	*Scaphirhynchus albus*
Sicklefin Chub,	*Macrhybopsis meeki*
Silver Chub,	*Macrhybopsis storeriana*

AMPHIBIANS

Cave Salamander,	*Eurycea lucifuga*
Many-ribbed Salamander,	*Eurycea multiplicata*
Grotto Salamander,	*Typhlotriton spelaeus*

BIRDS

Black-capped Vireo,	*Vireo atricapilla*
Eskimo Curlew,	*Numenius borealis*
Least Tern,	*Sterna antillarum*
Whooping Crane,	*Grus americana*

MAMMALS

Black-footed Ferret,	*Mustela nigripes*
Gray Myotis,	*Myotis grisescens*

KANSAS DEPARTMENT OF WILDLIFE & PARKS
Updated: August, 2009

APPENDIX F

REFERENCES CITED

KANSAS SURFACE WATER USE DESIGNATION PROGRAM

APPENDIX F
TABLE OF CONTENTS

DOC. APP. F-1

REFERENCES CITED: FISH AND UNIONID MUSSELS

Collins, J.T. 1993. Amphibians and reptiles in Kansas. Lawrence, Kansas: Museum of Natural History. Museum Public Education Series No. 13. 397 pp.

Cringan, M.S., and S.G. Haslouer. 1984. Soldier Creek water quality and conservation project stream biota and water quality investigation. Kansas Dept. Health and Env.

Cross, F.B., and M. Braasch. 1969. Qualitative changes in the fish-fauna of the Upper Neosho River system, 1952-1967. Trans. Kansas Acad. Sci. 71(3): 350-360.

Cross, F.B. 1967. Handbook of fishes of Kansas. Univ. Kansas Mus. Nat. Hist. Misc. Publ. 45: 1-357.

Cross, F.B., and J.T. Collins. 1995. Fishes in Kansas. Second ed. Univ. Kansas Mus. Nat. Hist. Pub. Ed. Ser. 14: 1-357.

Cross, F.B., O.T. Gorman, and S.G. Haslouer. 1983. The Red River shiner, *Notropis bairdi*, in Kansas with notes on depletion of its Arkansas River cognate, *Notropis girardi*. Trans. Kansas Acad. Sci. 86(2-3): 93-98.

Cross, F.B., and S.G. Haslouer. 1984. *Pimephales vigilax* (Pisces, Cyprinidae) established in the Missouri River basin. Trans. Kansas Acad. Sci. 87(3-4): 105-107.

Cross, F.B., R.L. Mayden, and J.D. Stewart. 1986. Fishes in the western Mississippi basin (Missouri, Arkansas and Red Rivers). *In* Offprints from the zoogeography of North American freshwater fishes. C.H. Hocutt and E.O. Wiley (eds), John Wiley & Sons, Inc., pp. 363-411.

Cross, F.B., and R.E. Moss. 1987. Historic changes in fish communities and aquatic habitats in plains streams of Kansas. *In* Community and evolutionary ecology of North American stream fishes. W.J. Matthews and D.C. Heins (eds.), Univ. Oklahoma Press, Norman, pp. 155-165.

Cross, F.B., R.E. Moss, and J.T. Collins. 1985. Assessment of dewatering impacts on stream fisheries in the Arkansas and Cimarron rivers (Kansas). Final Report to Kansas Fish and

Game Comm. 161 pp.

Deacon, J.E. 1961. Fish populations, following a drought, in the Neosho and Marais des Cygnes rivers of Kansas. Univ. Kansas Publ. Mus. Nat. Hist. 12(9): 259-427.

Deacon, J.E., and A.L. Metcalf. 1961. Fishes of the Wakarusa River in Kansas. Univ. Kansas Publ. Mus. Nat. Hist. 13(6): 309-322.

Eberle, M.E., S. Hoofer, N. Mandrak, and T. Wenke. 1997. Assessment of fish communities in western Kansas streams during 1994-1996. Report to U.S. Fish and Wildlife Service.

Eberle, M.E., G.W. Ernsting, J.R. Tomelleri, and S.L. Ernsting. 1989. Fishes of the Arkansas River in southwestern Kansas, 1987-1988. Unpublished.

Ernsting, G.W., J.R. Tomelleri, and M.E. Eberle. 1984. Fishes of Big Creek in Trego, Ellis, and Russell counties, Kansas: 1983-1984 Survey. Final Report to Kansas Fish and Game Comm.

Ernsting, G.W., and F.B. Cross. 1986. Fishes of Cheyenne Bottoms wildlife refuge and associated streams. Unpublished.

Fausch, K.D., and K.R. Bestgen. 1997. Ecology of fishes indigenous to the central and southwestern Great Plains. *In* Ecology and conservation of Great Plains vertebrates. F.L. Knopf and F.B. Samson (eds.), Springer-Verlag New York, pp. 131-166.

Ghedoti, M.J. 1998. An annotated list of the crayfishes of Kansas with first records of *Orconectes macrus* and *Procambarus acutus*. Trans. Kansas Acad. Sci. 101(1-2): 54-57.

Lessenden, G.A., and F.B. Cross. 1976. An analysis of habitats and fish distribution in the Neosho and Verdigris drainage basins in Kansas. Final Report to Kansas Fish and Game Comm.

Metcalf, A.L. 1959. Fishes of Chautauqua, Cowley and Elk counties. Kansas. Univ. Kansas Publ. Mus. Nat. Hist.11: 345-400.

Metcalf, A.L. 1966. Fishes of the Kansas River system in relation to zoogeography of the Great Plains. Univ. Kansas Publ. Mus. Nat. Hist.17: 23-189.

Minckley, W.L. 1959. Fishes of the Big Blue River Basin, Kansas. Univ. Kansas Publ. Mus. Nat. Hist. 11(7): 401-442.

Minckley, W.L. and F.B. Cross. 1959. Distribution, habitat and abundance of the Topeka shiner, *Notropis topeka* (Gilbert) in Kansas. American Midland Nat. 6(1): 210-217.

Platt, D.R., F.B. Cross, H. Klaassen, T. Wenke, J.C. Bass, D. Distler, and R. Boles. 1974. Rare, endangered and extirpated species in Kansas. I. Fishes. Trans. Kansas Acad. Sci. 76(2): 97-106.

Pflieger, W.L. 1987. An introduction to the crayfish of Missouri. Missouri Dept. Conservation, Jefferson City. 16 pp.

Pflieger, W.L. 1996. The crayfishes of Missouri. Missouri Dept. Conservation, Jefferson City. 152 pp.

Robins, C.R., R. Bailey, C. Bond, J. Brooker, E. Lachner, R. Lea, and W. Scott. 1991. Common and scientific names of fishes from the United States and Canada, Fifth ed. American Fish. Soc. Spec. Publ. 20. 1-183.

Sanders, R.M.,Jr., D.G. Huggins, and F.B. Cross 1993. The Kansas River system and its biota. *In* Proceedings of the symposium on restoration planning for the rivers of the Mississippi River ecosystem. L.W. Hesse, C.B. Stalnaker, N.G. Benson, and J.R. Zuboy (eds.). U.S. Dept. Interior, Natl. Biol. Surv., Biol. Report 19, Washington, D.C. [vii + 502 pp], pp. 295-326.

Schelske, C.L. 1957. An ecological study of the fishes of the Fall and Verdigris rivers in Wilson and Montgomery counties, Kansas, March 1954 to February 1955. Emporia State Research Studies 5(3): 31-56.

Smith, G.R., and D.R. Fisher. 1970. Pleistocene and recent environments of the central Great Plains. Dept. Geol. Univ. Kansas Spec. Publ. 3: 259-277.

Tomelleri, J.R., M.E. Eberle, and G.W. Ernsting. 1987. Survey of the fishes of the upper Arkansas River in August 1987. Unpublished.

Turgeon, D.D., *et al.* 1998. Common and scientific names of aquatic invertebrates from the United States and Canada: mollusks, Second ed. American Fish. Soc. Spec. Publ. 26.

DOC. APP. F-2

REFERENCES CITED: AQUATIC MACROINVERTEBRATES

APHA. 1989. Standard methods for the examination of water and wastewater (seventeenth edition). American Public Health Association, American Water Works Association, and Water Pollution Control Federation.

Bae,Y.J. and W.P. McCafferty. 1991. Phylogenetic systematics of the Potamanthidae (Ephemeroptera). Trans. Am. Ent. Soc. 117(3-4):1-143.

Beck, W.M. 1976. Biology of the larval Chironomids. Florida Dept. Environ. Reg. Tech. Series2(1):58.

Bednarik, A.F. and W.P. McCafferty. 1979. Biosystematic revision of the genus *Stenonema*. Can. Bull. Fish. Aquat. Sci. 201:73.

Bennett, D.V. and E.F. Cook. 1981. The semiaquatic Hemiptera of Minnesota. Univ. Minnesota Ag. Exp. Stn. Tech Bull. 332.

Bird, G.A. and H.B.N. Hynes. 1981. Movement of immature aquatic insects in a lotic habitat. Hydrobiologia 77:103-112.

Boesel, M.W. 1974. Observations on the Coelotanypodini of the northeastern states, with keys to the known stages. J. Kans. Ent. Soc. 47(4):417-432.

Boesel, M.W. 1985. A brief review of the genus *Polypedilum* in Ohio, with keys to known stages of species occurring in northeastern U.S. Ohio J. Sci. 85(5):245-262.

Brigham, A.R., W.U. Brigham and A. Gnilka [eds.]. 1982. Aquatic insects and Oligochaetes of North and South Carolina. Midwest Aquatic Enterprises.

Brown, H.P. 1972. Aquatic dryopid beetles of the U.S. Biota of freshwater ecosystems identification manual #6. EPA 18050 ELD04/72.

Burch, J.B. 1972. Freshwater sphaeriacean clams of North America. Biota of freshwater ecosystems identification manual #3. EPA 18050 ELD03/72.

Burch, J.B. 1973. Freshwater Unioncean Clams of North America. Biota of freshwater ecosystems identification manual #11. EPA 18050 ELD03/73.

Burch, J.B. 1982. Freshwater snails of North America. EPA 600/4-78-060.

Burks, B.D. 1953. The Ephemeroptera of Illinois. Bull. Ill. Nat. Hist. Surv. 26(1):216.

Cairns, J. and K.L. Dickson. 1980. The ABC's of biological monitoring. *In* C.H. Hocutt and J.R. Stauffer [eds.], Biological monitoring of fish. Lexington Books.

Cannings, R.A. 1981. The larvae of *Sympetrum madidum.* Pan. Pac. Ent. 57(2):341-346.

Capelli, G.M. and J.F. Capelli. 1980. Hybridization between crayfish of the genus *Orconectes*: Morphological evidence. Crustaceana 39(2):121-132.

Couch, K.J. 1997. An Illustrated Guide to the Unionid Mussels of Kansas. Karen J. Couch.

Cummins, K.W. and M.J. Klug. 1979. Feeding ecology of stream invertebrates. Ann. Rev. Ecol. Syst. 10:147-172.

Dance, K.W. and H.B.N. Hynes. 1980. Some effects of agricultural land use on stream insect communities. Environ. Poll. Serv. A. 22.

Davis, W.S. and T.P. Simon. [ed.]. 1994. Biological Assessment and Criteria. Lewis.

Davenport, T.E. and M.H. Kelly. 1983. Water resource data and preliminary trend analysis for h Highland Silver Lake Monitoring and Evaluation Project, Madison County, Illinois. Phase II. Report No. IEPA/WPC/83-013. Illinois Environmental Protection Agency, Springfield.

Edmonds, G.F., S.L. Jensen and B. Lewis. 1976. The mayflies of North and Central America Univ. Minnesota Press.

Edmondson, W.T. [ed.]. 1959. Freshwater biology. John Wiley and Sons.

Ferrington, L.C. 1983. Key to the Chironomidae of North America. State Biol. Surv. Kans. (Unpublished.)

Fittkau, E.J. and S.S. Roback. 1983. 5. The larvae of Tanypodinae of the Holarctic region - keys and diagnoses. Ent. Scand. 19:33-110.

Fredeen, F.J.H. 1981. The seven larval instars of *Simulium luggeri.* Can. Ent. 113:161-165.

Garrison, R.W. 1981. Description of the larvae of *Ishnura gemina* with a key and new characters for the separation of sympatric *Ishnura* larvae. Ent. Soc. Am. 74:525-530.

Gaufin, A.R. 1973. Use of aquatic invertebrates in the assessment of water quality, p. 96-116. *In* J. Cairns and K.L. Dickson [eds.], Biological methods for the assessment of water quality. ASTM STP 528.

Gelhaus, J.K. 1986. Larvae of the cranefly genus *Tipula* in North America. Univ. Ks. Sci. Bull.53(3):121-182.

Ghedoti, M.J. 1998. An annotated list of the crayfishes of Kansas with first records of *Orconectes macrus* and *Procambarus acutus*. Trans. Kansas Acad. Sci. 101(1-2): 54-57.

Grodhaus, G. 1987. *Endochironomus* Kieffer, *Tribelos Townes, Synendotendipes*, n.gen., and *Endotribelos*, n. gen., of the Nearctic region. J. Kans. Ent. Soc. 60(2):167-247.

Hamilton, S.W. and J.K. Gelhaus. 1981. Kansas caddisflies with special reference to larvae. State Biol. Surv. Kans. (Unpublished.)

Hilsenhoff, W.L. 1975. Aquatic insects of Wisconsin. Univ. Wisconsin Nat. Hist. Council Pub. #

Hilsenhoff, W.L. 1981. Aquatic insects of Wisconsin. Univ. Wisconsin Nat. Hist. Council Pub. #

Hilsenhoff, W.L. and K.L. Schmude. 1992. Riffle beetles of Wisconsin (Coleoptera: Dryopidae, Elmidae, Lutrochidae, Psephenidae) with notes on distribution, habitat, and identification. Grt. Lakes Ent. 25(3):191-213.

Hiltunen, J.K. and D.J. Klemm. 1980. Guide to the Naididae of North America. EPA-600/4-80-031.

Hobbs, H.H. 1972. Crayfishes of North and Middle America. Biota of freshwater ecosystems identification manual #9. EPA 18050 ELD05/72.

Holsinger, J.R. 1972. The freshwater amphipod crustaceans of North America. Biota of freshwater ecosystems identification manual #9. EPA 18050 ELD04/72.

Huggins, D.G. 1987. The Plecoptera of Kansas. State Biol. Surv. Kans. (Unpublished.)

Huggins, D.G. and G.L. Harp. 1985. The nymph of *Gomphus ozarkensis* Westfall. J. Kans. Ent. Soc. 58(4):656-661.

Huggins, D.G. and M.F. Moffett. 1988. Proposed biotic and habitat indices for use in Kansas streams. Report No. 35, Kansas Biological Survey, Lawrence.

Hungerford, H.B. 1954. The genus *Rheumatobes* Bergroth. Univ. Kans. Sci. Bull. 36(7):529-588.

Karr, J.R. and E.W. Chu. 1999. Restoring Life in Running Waters. Island Press.

Kenk, R. 1972. Freshwater planarians of North America. Biota of freshwater ecosystems identification manual #1. EPA 18050 ELD02/72.

Klemm, D.J. 1972. Freshwater leeches of North America. Biota of freshwater ecosystems identification manual #8. EPA 18050 ELD05/72.

Klemm, D.J. 1982. Leeches of North America. EPA-600/3-82-025.

Leonard, A.B. 1959. Gastropods in Kansas. K.U. Mus. Nat. Hist. and St. Biol. Surv. Ks. Misc. Pub. 20.

Lenat, D.R., D.L. Penrose and K.W. Eagleson. 1981. Variable effects of sediment addition on stream benthos. Hydrobiologia 79:187-194.

Lewis, P.A. 1974. Taxonomy and ecology of *Stenonema* mayflies. EPA-670/4-74-006.

Loeb, S. L. and A. Spacie [eds.]. 1994. Biological monitoring of aquatic systems. CRC Press.
Mason, W.T. 1973. An introduction to the identification of chironomid larvae. EPA.

Matta, J.F. and D.E. Peterson. 1985. The larvae of six Nearctic *Hydroporus* of the subgenus *Neoporus*. Proc. Acad. Nat. Sci. Phil. 137:53-60.

McCafferty, W.P. and R.D. Waltz. 1990. Revisionary synopsis of the Baetidae (Ephemeroptera) of North and Middle America. Trans. Am. Ent. Sco. 116(4):769-799.

McCafferty, W.P. 1998. Aquatic Entomology. Jones and Bartlett.

Merrit, R.W. and K.W. Cummins. [eds.]. 1978. Aquatic insects of North America (first edition). Kendal and Hunt Pub. Co.

Merrit, R.W. and K.W. Cummins. [eds.]. 1984. Aquatic Insects of North America (second edition). Kendal and Hunt Pub. Co.

Merrit, R.W. and K.W. Cummins. [eds.]. 1996. Aquatic Insects of North America (third edition). Kendal and Hunt Pub. Co.

Murray, H.D. and A.B. Leonard. 1962. Unionid mussels in Kansas. K.U. Mus. Nat. Hist. and St. Biol. Surv. Ks. Misc. Pub. #28.

Needham, J.G. and M.J. Westfall. 1954. Dragonflies of North America. Univ. Cal. Press.

Odum, E.P. 1971. Fundamentals of ecology. W.B. Saunders.

Oesch, R.D. 1884. Missouri naiades, a guide to the mussels of Missouri. Mo. Dept. Consv.

O'Hop, J. and B. Wallace. 1983. Invertebrate drift, discharge, and sediment relations in a southern Appalachian headwater stream. Hydrobiologia 93:71-84.

Page, L.M. 1985. The crayfishes and shrimps of Illinois. Ill. Nat. Hist. Surv. 33(4):448.

Patrick, R. 1977. The importance of monitoring change. *In* J. Cairns, K.L. Dickson and G.F. Westlake [eds.], Biological monitoring of water and effluent quality. ASTM STP 607.

Pedersen, E.R. and M.A. Perkins. 1986. The use of benthic invertebrate data for evaluating impacts of urban runoff. Hydrobiologia 139:13-22.

Pennak, R.W. [ed.]. 1953. Freshwater invertebrates of the United States (first edition). Ronald Press.

Pennak, R.W. [ed.]. 1978. Freshwater invertebrates of the United States (second edition). Ronald Press.

Pennak, R.W. [ed.]. 1989. Freshwater invertebrates of the United States (third edition). John Wiley and Sons.

Pflieger, W.L. 1987. An introduction to the crayfish of Missouri. Missouri Dept. Conservation, Jefferson City. 16 pp.

Pflieger, W.L. 1996. The crayfishes of Missouri. Missouri Dept. Conservation, Jefferson City. 152 pp.

Plafkin, J.L., M.T. Barbour, K.D. Porter, S.K. Gross and R.M. Hughes. 1989. Rapid bioassessment protocols for use in streams and rivers: Benthic macroinvertebrates and fish. EPA/444/4-89/001.

Ploskey, G.R. and A.V. Brown. 1979. Downstream drift of the mayfly *Baetis flavistriga* as a passive phenomena. Am. Midland Nat. 104(2):405-409.

Reger, S.J. and N.R. Kevern. 1981. Benthic macroinvertebrate diversity in three Michigan streams. J. Fresh. Ecol. 1(2): 179-187.

Roback, S.S. 1985. The immature chironomids of the eastern United States. VI. Pentanerini - genus *Ablabesmyia*. Proc. Acad. Nat. Sci. Phil. 137(2):153-212.

Rosenburg, D. M. and V. H. Resh. 1993. Freshwater biomonitoring and benthic macroinvertebrates. Routledge, Chapman and Hall.

Schmude, K.L. and W.L. Hilsenhoff. 1986. Biology, ecology, larval taxonomy, and distribution of Hydropsychidae in Wisconsin. Grt. Lk. Ent. 19(3):123-145.

Schuster, G.A. and D.A. Etnier. 1978. A manual to the identification of the larvae of the caddisfly genera *Hydropsyche* (Pictet) and *Symphitopsyche* (Ulmer) in eastern and central North America. EPA 600/4-78-060.

Soponis, A.R. and C.L. Russel. 1982. Identification of instars and species in some larval Polypedilum. Hydrobiologia 94:25-32.

Stark, B.P. and A.R. Gaufin. 1976. The nearctic genera of Perlidae. Misc. Pub. Ent. Soc. Am. 10(1):1-78.

Stewart, K.W. and B.P. Stark. 1984. Nymphs of North American Perlodinae genera. Grt. Basin Nat. 44(3)373-415.

Stimpson, K.S., D.J. Klemm and J.K. Hiltunen. 1982. A guide to the Tubificidae of North America. EPA 600/3-82-033.

Taylor, B.R. and J.C. Roff. 1986. Long-term effects of highway construction on the ecology of a southern Ontario stream. Environ. Poll. Ser. A 40.

Trottier, R. 1969. A comparative study of the morphology of some *Sympetrum* larvae from eastern Canada. Can. J. Zoo. 47:457-460.

Usinger, R.L. 1956. Aquatic insects of California with keys to North American genera. Univ. Cal. Press.

Weber, C.I. 1973. Biological monitoring of the aquatic environment, p. 46-60. *In* J. Cairns and K.L. Dickson [eds.], Biological methods for the assessment of water quality. ASTM STP 528.

Weber, C.I. 1981. Evaluation of the effects of effluents on aquatic life in receiving waters - an overview, p. 3-13. *In* J.M. Bates and C.I. Weber [eds.], Ecological assessment of effluents: Impacts on communities of indigenous organisms. ASTM STP 730.

Westfall, M.J. and K.J. Tennessen. 1979. Taxonomic clarification within the genus *Dromogomphus* (Selys). Florida Ent. 62(3):266-273.

Whiting, E.R. and H.F. Clifford. 1983. Invertebrates and runoff in a small northern stream, Edmonton, Alberta, Canada. Hydrobiologia 102:73-80.

Wiggins G.B. 1977. The larvae of North American caddisfly genera. Univ. Toronto Press.

Williams, W.D. 1972. Freshwater isopods of North America. Biota of freshwater ecosystems identification manual #7. EPA 18050 ELD05/72.

Williams, A.B. and A.B. Leonard. 1952. The crayfishes of Kansas. Univ. Kans. Sci. Bull. 34(15):961-1011.

Wolfe, W.G. and J.F. Matta. 1981. Notes on nomenclature and classification of *Hydroporus* subgenera with the description of a new genus of Hydroporini. Pan. Pac. Ent. 57(1):149-175.

Wynes, D.L. and T.E. Wissing. 1981. Effects of water quality on fish and macroinvertebrate communities of the Little Miami River. Ohio J. Sci. 81(6):259-267.

Young, F.N. 1985. A key to the species of *Hydrocanthus* Say, with descriptions of new taxa. Proc. Acad. Nat Sci. Phil. 137:90-98.

Zwick, P. 1984. Notes on the genus *Agnetina* (=*Phasganophora*). Aquat. Ins. 6(2):71-79.

DOC. APP. F-3

REFERENCES CITED: WATER CHEMISTRY

APHA 1985. Standard methods for the examination of water and wastewater (16th edition). American Public Health Association, American Water Works Association, and Water Pollution Control Federation, Washington.

APHA 1989. Standard methods for the examination of water and wastewater (17th edition). American Public Health Association, American Water Works Association, and Water Pollution Control Federation, Washington.

APHA 1992. Standard methods for the examination of water and wastewater (18th edition). American Public Health Association, American Water Works Association, and Water Pollution Control Federation, Washington.

CFR 1978. Code of federal regulations, protection of environment, 40 CFR Part 36 and CFR 141.2. Office of Federal Register, National Archives and Records Administration, Washington.

EPA 1979a.. NPDES Compliance Sampling Inspection Manual, U.S. EPA, Office of Water Enforcement, Washington, D.C., MCD-51.

EPA 1979b. Interim NPDES Compliance Biomonitoring Inspection Manual, U.S. EPA, Office of Water Enforcement and Permits, WCD-62.

EPA 1980. Prescribed procedures for measurement of radioactivity in drinking water. EPA 600/4-80- 032. Environmental Protection Agency Office of Research and Development, Cincinnati, Ohio.

EPA 1982. Methods for organic chemical analysis of municipal and industrial wastewater. EPA 600/4- 82-057. EMSL-CIN, Cincinnati, Ohio.

EPA 1983. Methods for chemical analysis of water and waste. EPA 600/4-79-020. Revised March 1983 and 1979. EMSL-CIN, Cincinnati, Ohio.

EPA 1984. NPDES Compliance Inspection Manual, U.S. EPA, Office of Water Enforcement and Permits.

KDHE 1984. Division of Laboratories, Policy Statement and Procedures Manual.

KDHE 1985. Draft Standard Operating Procedures W001 through W033.

KDHE 1995a. Kansas lake and wetland water quality monitoring program quality assurance management plan. Office of Science and Support, Division of Environment, Kansas Department of Health and Environment, Topeka, Kansas.

KDHE 1995b. Groundwater quality monitoring program quality assurance management plan. Office of Science and Support, Division of Environment, Kansas Department of Health and Environment, Topeka, Kansas.

REFERENCES CITED: WATER CHEMISTRY (GROUNDWATER NETWORK)

Bailey, P.E. and Ward, W.D. 1990. Understanding ground-water contamination: an orientation manual. Executive Enterprises Publications Co., Inc., New York.

Cole-Parmer Instrument Company. Instruction Manual for pH Meter Models 5996-50, 5996-60, 5996- 70, and 5996-80.

Fisher Scientific Company. Instruction Manual for Digital Conductivity Meter.

Spruill, T.B. 1983. Statistical summaries of selected chemical constituents in Kansas ground-water supplies, 1976-81. U.S. Geological Survey Open-File Report 83-263.

Spruill, T.B. 1990. Monitoring regional ground-water quality--statistical considerations and description of a monitoring network in Kansas. U.S. Geological Survey Water-Resources Investigations Report 90-4159.

U.S. Environmental Protection Agency. 1985. Practical guide for ground-water sampling. EPA/600/2-85/104.

Vitale, R.J., Braids, O., and Schuller, R. 1991. Ground-water sample analysis. *In* Nielsen, D.M., [ed.], Practical handbook of ground-water monitoring. Lewis Publishers, Inc.

Wood, W.W. 1976. Guidelines for collection and field analysis of ground-water samples for selected unstable constituents. U.S. Geological Survey Techniques of Water-Resources Investigations, Book 1, Chapter D2.

DOC. APP. F-4

REFERENCES CITED: LAKES AND WETLANDS

APHA. 1992. Standard methods for the examination of water and wastewater (17th edition). American Public Health Association, American Water Works Association, and Water Pollution Control Federation, Washington, D.C.

Borman, S., R. Korth, and J. Temte. 1997. Through The Looking Glass: A Field Guide To Aquatic Plants. Wisconsin Lakes Partnership and Wisconsin Department of Natural Resources. Reindl Printing, Inc., Merrill, Wisconsin.

Brooks, R.E. and L.A. Hauser. 1981. Aquatic vascular plants of Kansas. I: Submersed and floating leaved plants. Technical Publication No. 7 of the State Biological Survey of Kansas. University of Kansas Press, Lawrence, Kansas.

Fassett, N.C. 1972. A manual of aquatic plants. University of Wisconsin Press, Madison, Wisconsin.

KDHE. 2000a. Stream chemistry monitoring program quality assurance management plan. Office of Science and Support, Division of Environment, Kansas Department of Health and Environment, Topeka, Kansas.

KDHE. 2000b. Groundwater quality monitoring program quality assurance management plan. Office of Science and Support, Division of Environment, Kansas Department of Health and Environment, Topeka, Kansas.

Prescott, G.W. 1962. Algae of the western Great Lakes area. William C. Brown Company, Dubuque, Iowa.

Prescott, G.W. 1984. How To know The freshwater algae. William C. Brown Company, Dubuque, Iowa.

Smith, G.M. 1950. The freshwater algae of the United States. McGraw-Hill Company, New York, New York.

Winterringer, G.S. and A.C. Lopinot. 1977. Aquatic plants of Illinois. Illinois State Museum,

Springfield, Illinois.

Wood, R.D. 1967. Charophytes of North America. University of Rhode Island, Kingston, Rhode Island.

DOC. APP. F-5

REFERENCES CITED: GENERAL

Docking Institute of Public Affairs. 1999. Report on 1999 use attainability analysis forums. 18 pp.